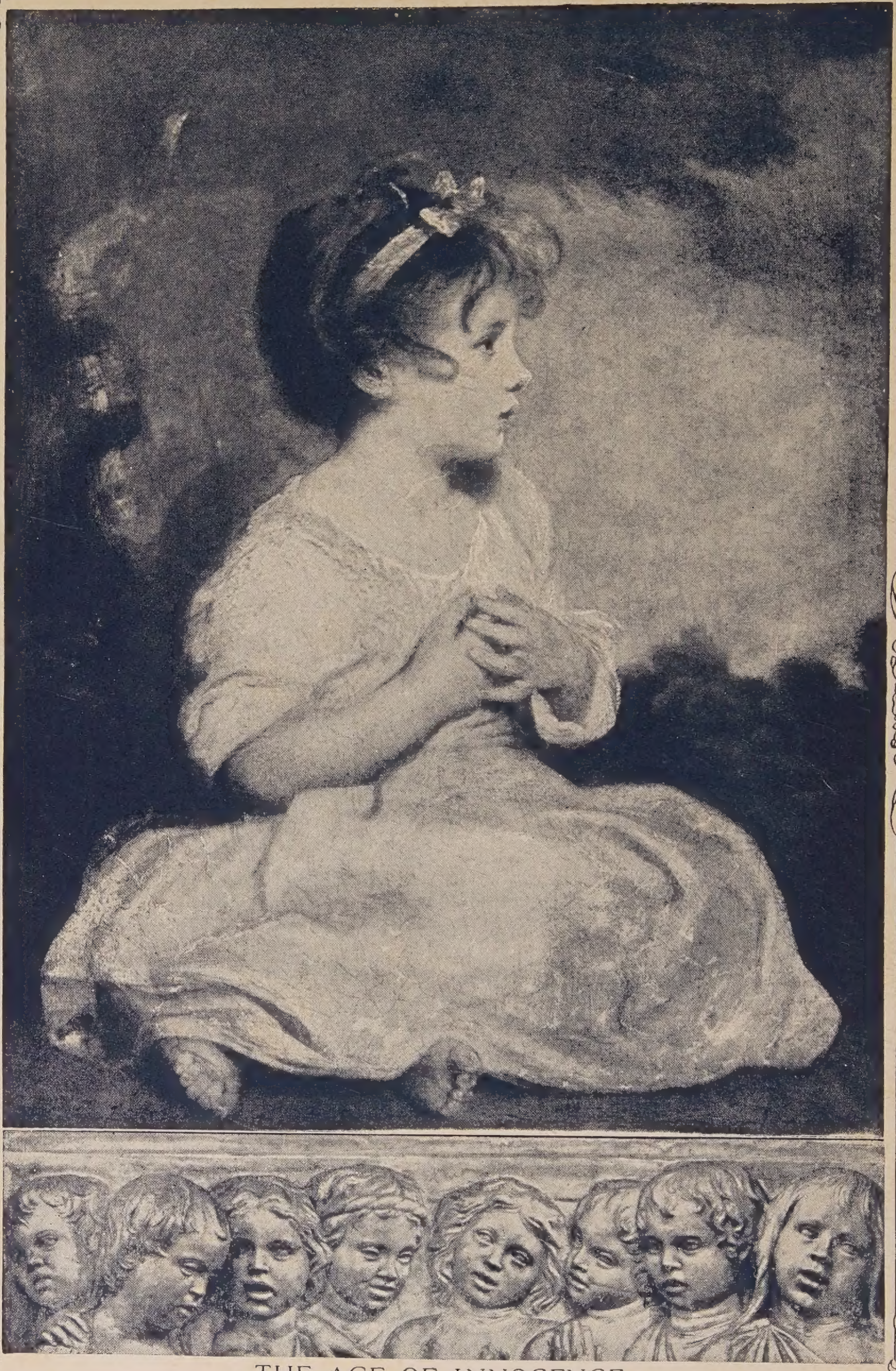
THE BOOK
of
KNOWLEDGE



THE AGE OF INNOCENCE

This famous picture was painted by Sir Joseph Reynolds about 150 years ago, and now hangs in the National Gallery in London. The children's faces at the bottom are from a famous sculpture of singers in the Cathedral at Florence.

The Book *of* Knowledge

The Children's Encyclopædia

EDITORS-IN-CHIEF

ARTHUR MEE
Temple Chambers, London

HOLLAND THOMPSON, Ph. D.
The College of the City of New York

WITH AN INTRODUCTION BY

JOHN H. FINLEY, LL. D.
Late President of the College of the City of New York
Commissioner of Education of the State of New York

DEPARTMENTAL EDITORS

All Countries
M. Alston Buckley

Natural History
Ernest Ingersoll

Plant Life
Edward Step

Book of Wonder
Arthur Mee

Familiar Things
Harold Begbie

Men and Women
Ernest A. Bryant

Our Own Life
C. W. Saleeby, M.D.

Famous Books
J. A. Hammerton

School Lessons
A. M. Skinner, B.S.

Poetry and Rhymes
A. Von Hartmann

Dominion of Canada
W. Peterson, D. Litt., LL. D.

The United States
Holland Thompson, Ph. D.

The Earth
Ivin Sickels, M S., M.D.

Golden Deeds
M. Perry Mills

Stories and Legends
Edward Wright

Things to Make and Do
E. R. Sayre, B.A.

Volume XIII

New York: THE GROLIER SOCIETY
London: THE EDUCATIONAL BOOK CO.

Text and Illustrations in this work are protected by copyright as follows:

Copyright, 1911, 1912, 1918, 1919, 1921, 1923, by THE GROLIER SOCIETY

Copyright, 1911, 1918, 1921, by THE EDUCATIONAL BOOK CO.

Copyright, 1910, 1911, 1912, 1918, 1919, 1921, 1922, by M. PERRY MILLS

Copyright, 1908, by AMALGAMATED PRESS, LTD.

Copyright, 1868, 1870, 1872, 1874, 1875, 1876, 1878, 1881, 1883, 1884, 1886, 1887, 1888, 1889, 1890, 1891, 1902, 1906, by TICKNOR & FIELDS, JAMES R. OSGOOD & CO., and HOUGHTON, MIFFLIN & CO.

Copyright, 1874, 1880, 1892, 1894, 1895, 1896, 1904, 1908, by CHARLES SCRIBNER'S SONS

Copyright, 1908, 1909, by THE CENTURY CO.

Copyright, 1897, by HARPER & BROS.

Copyright, 1906, by THE BAKER & TAYLOR CO.

Copyright, 1901, 1902, 1906, 1907, 1909, by H. C. WHITE CO.

Copyright, 1897, 1907, by THE AMERICAN BOOK CO.

Copyright, 1890, 1899, by JAMES WHITCOMB RILEY

Copyright by PHOTOGRAPHISCHE GESELLSCHAFT

Copyright by KEYSTONE VIEW CO.

Copyright by UNDERWOOD & UNDERWOOD

Copyright by BROWN BROS.

Copyright by BROWN & DAWSON

Copyright by B. L. SINGLEY

The poems by Thomas Bailey Aldrich, Phœbe Cary, Ralph Waldo Emerson, Oliver Wendell Holmes, James Russell Lowell, John Greenleaf Whittier, Henry Wadsworth Longfellow, Edmund Clarence Stedman, Richard Watson Gilder, John Hay, Edward R. Sill, Bayard Taylor and Celia Thaxter included in this work are reprinted by permission of, and by special arrangement with, Houghton Mifflin Company, the authorized publishers of the Works of these authors. The poems by Robert Louis Stevenson, Eugene Field, Mary Mapes Dodge, Richard Henry Stoddard and Henry Van Dyke included in this work are printed by permission of Charles Scribner's Sons.

CONTENTS OF THIS VOLUME

This is a short guide only to the principal contents of this volume. It is not possible to give the titles of all the Poems and Rhymes, Legends, Problems, color pages, questions in the Wonder Book, and many other things that come into the volume; but in all cases the pages where these parts of our book begin are given. The full list of these things comes into the big index to the whole work.

PAGE

THE BOOK OF THE EARTH

The Pressure of the Air . . . 3977
Hot Things and Cold Things . . 4083
Different Kinds of Heat . . . 4229

THE BOOK OF THE UNITED STATES

The Most Northern Territory . . 4165

THE BOOK OF FAMILIAR THINGS

A Piece of Rope 4003
How We Get Kerosene . . . 4057
The Wonder of the Radio . . . 4069
How Coffee Comes to Us . . . 4127
The Life of the Earth 4143
A Little Talk on Sculpture . . . 4171
How Men May Make Stone . . 4241

THE BOOK OF WONDER

Where Does Salt Come From? . . 4017
What Causes a Cramp? . . . 4018
How Does Fog Deaden Sound? . . 4019
What Are Freckles? 4020
Do We Always Wake When We Have Had Sleep Enough? 4021
Why Does Thunder Turn Milk Sour? . 4022
Why Are There Two Tides a Day? . 4023
Why Does Heat Make Paper Curl Up? 4024
Where Does Dust Come From? . . 4109
How Many Worlds Are There? . . 4110
Can Anything Travel Faster than Thought? 4112
Why Does a Hen Not Crow? . . 4113
Why Are There No Green Flowers? . 4114
Shall We Ever Be Able to Get to Any Other Planet? 4115
Will the Earth Ever Stop Spinning? . 4116
Why Does It Not Give Pain to Have Our Hair Cut? 4117

THE BOOK OF NATURE

Along a Country Road . . . 3943
The Habits of Flowers . . . 4013
The Families of Plants . . . 4133
Roadside Plants and Weeds . . 4205

THE BOOK OF CANADA

The Ocean Wealth of Canada . . 3953

PAGE

THE BOOK OF MEN AND WOMEN

Men Who First Wrote English . . 3935
Some Famous Monks . . . 4029
The French Revolutionists . . . 4099
Famous Modern Thinkers . . . 4155
Painters of the United States . . 4215

THE BOOK OF OUR OWN LIFE

Hearing and Speaking . . . 3997
Talking and Singing 4093

THE BOOK OF GOLDEN DEEDS

The Arab Patriot of Algeria . . 4025
The Boy Who Took a Man's Place . 4026
A Band of Noble Men . . . 4026
The Girl Who Sold Her Hair . . 4027
A Prince Who Gave Up His Freedom 4027
A Woman's Ride in the Sea . . . 4089
A Brave Boy's Remarkable Swim . 4090
A Boy's Love for His Mother . . 4091
The Love that Is Stronger than Death 4091
The Man Who Loved Children . . 4191
The Boys Who Saved the Boat . . 4192

THE STORY OF FAMOUS BOOKS

John Halifax, Gentleman . . . 3969
Tom Brown's School Days . . . 4137
The Toilers of the Sea . . . 4223

THE BOOK OF STORIES

The Story of Fairyfoot . . . 4049
The Dog that Knew His Master . . 4051
Undine, the Water Nymph . . . 4053
Æsop's Fables 4056
The Magic Tinder-Box . . . 4123
How Gotham Got a Bad Name . . 4126
Legends and Tales of the Rhine . 4235

THE BOOK OF POETRY

Tennyson's "In Memoriam" . . 3985
The Flight of Peter Bell . . . 3989
Armageddon 3990
Why the Robin's Breast is Red . . 3990
Memory 3990
Rose and Root 3990
Birds 3991
The Elixir 3991

PAGE
London, 1802 3991
To the Lord General Cromwell . . 3991
Abide With Me 3991
Incident of the French Camp . . 3992
Peace 3992
The Builders 3992
Jesus Bids Us Shine 3992
Composed Upon Westminster Bridge . 3992
The Cotter's Saturday Night . . 4063
Shakespeare 4065
To a Butterfly 4065
Thy Way, Not Mine, O Lord . . 4065
The Character of a Happy Life . . 4065
The Spacious Firmament on High . 4066
Lullaby! O Lullaby! 4066
Ambitious Sophy 4066
The Baby and the Brook . . . 4066
Be Patient with the Children . . 4066
The Revenge 4183
Faith 4184
The Boy and the Angel . . . 4185
An Evening Hymn 4185
A Name in the Sand 4186
The Baron's Last Banquet . . . 4186
Jesus, Tender Shepherd . . . 4186
A Woman's Shortcomings . . . 4187
Sudden Light 4187
The Mouse and the Cake . . . 4187
The Arrow and the Song . . . 4188
Birds in Summer 4188
Common Things 4188
Little Verses (with music) 3993, 4067, 4189

THE BOOK OF ALL COUNTRIES

The Heart of Asia 3923
The Empire of Eternal Sun . . . 4077

THINGS TO MAKE AND TO DO

How to Know Sailing Ships . . . 3959
Ices Made without a Freezer . . 3961
How to Keep Ants as Pets . . . 3962

PAGE

FIRST AID TO THE INJURED

What To Do Until the Doctor Comes . 3963
The Bones and Arteries of Our Body . 4200
Simple Ways of Making Designs . . 3965
Out-door Games for Boys . . . 3966
A Bathing Suit for a Girl . . . 3967
A Little Vegetable Garden (middle of August) 3968
A Floral Barometer 3968
Building Sand Castles 4039
Some Games Played with Hoops . . 4040
A Useful Little Crochet Purse . . 4042
The Exciting Game of Stool-Ball . 4043
Games Played with Dominoes . . 4044
Things To Do in Awkward Situations . 4045
How to See Through a Brick . . 4046
The Coin and the Handkerchief . . 4047
The Mysterious Tumbling Tablet . 4047
The Little Black Tangrams . . . 4193
Games for the Schoolroom . . . 4194
How to Keep a Secret in Writing . 4195
Name-Pictures and How to Make Them 4196
Tricks with a Set of Dominoes . . 4197
How to Make Paper Flowers . . 4198
A Bonnet for a Baby Doll . . . 4199
Two Ways of Splicing a Stick . . 4202
The Puzzle of the Trees in the Park . 4202
The Problem of the Traveler's Dinner 4202
Games to Play in a Hay-field . . 4203

THE BOOK OF SCHOOL LESSONS

FRENCH

La Plus Sage Fille du Wessex . . 4055
Le Roi, le Noble, et le Paysan . . 4056
Picture Stories 4082
La Jeune Fée du Lac Van . . . 4126
Nursery Rhymes of Children of France 4190

COLORED PLATES

The Age of Innocence . . *Frontispiece*
Mighty Sculptures of the World . . 4175

In this picture we see the great wall of mountains that encloses the land of Tibet and has acted as a barrier against invasion for centuries. It is the difficulty of getting into the country, across its barriers of mountains and deserts, that makes Tibet still the least-known country in the world.

THE HEART OF ASIA

TIBET, TURKESTAN, MONGOLIA, & AFGHANISTAN

CONTINUED FROM 3864

IN the stories of the countries of Europe we often read of the waves of settlers and hordes of conquerors rolling westwards from the heart of Asia. Adventurous explorers have ever been drawn, as with a magnet, to search out the secrets locked up in this great and wonderful heart of Asia, as large as the whole of Europe; but, for the most part, the vast lands, which have sent forth teeming millions to fashion the face of Europe, lie silent in inexpressible grandeur and loneliness.

In Europe more than 400 millions of people live and work, and call for food from near and far; but there is a population of only about 21 millions in that part of Asia lying between Siberia and India on the north and south, and Persia and China on the east and west. By far the greater number of these 21 millions make their homes in tents, and wander about in search of fresh pasture for the immense flocks and herds that they rear on the steppes; others till the soil of the fertile valleys and oases that are made to smile by the life-giving waters of the rivers. The chief point in Central Asia is the "Roof of the World"—the Pamir Plateau—north of the great bend which the Indus makes when it breaks through the Himalaya Mountains. The treeless and rocky valleys of this tableland, covered with snow for many months of the year, equal in height the highest mountains in Switzerland, being about three miles above the level of the sea. The mountains that cross it and surge around it rise a mile or more higher still. To understand the connection of this well-named "Roof of the World" with the immense ranges that meet upon it, we must study a relief map of Asia.

From the south-west corner of the plateau spring the mighty heights of the Himalayas, the abode of snow, extending for 1,500 miles eastwards above the plains of India. The majestic range of Kwen Lun, with the loftiest passes in the world, runs eastward from the south-east corner of the Pamirs. From the north of the plateau the great Thian Shan range—the "Mountains of Heaven"—runs eastward for a distance as far as from London to Petrograd, towards the Mongolian plateau, which in turn is crossed by the Altai Mountains, south of Siberia. From the south-west of the Pamir Plateau the ranges of the Hindu Kush cross Afghanistan. These run on to form the northern boundary of the Persian desert, and join the Elburz Mountains south of the Caspian Sea. Many shorter ranges, such as the Karakorum or Mustagh—whose greatest heights tower not far below the height of the main Himalayas—and the Suliman, gather like buttresses round the "Roof of the World."

THE WHITE MOUNTAIN PEAKS THAT LOOK DOWN UPON CENTRAL ASIA

If we could but look down from above on these giant mountain walls—the framework of Central Asia—what a scene of extraordinary beauty and desolation would meet our eyes! Nearest us would be the dazzling white of the snowy peaks, for most of the mountains of Central Asia are far above the line of perpetual snow, surrounded by immense glaciers and ice-fields. In contrast with all this would be the dark, bare pinnacles of rock, the fearsome precipices and cliffs, girdled lower down by dark forests and rushing streams. From these, grassy slopes stretch downwards, covered with lighter vegetation, and relieved in places with masses of crimson rhododendrons and other Alpine flowers.

Between these mountain walls, which act as barriers to the moisture in the air, to plants and animals, and to races of men, lie the countries that make up Central Asia. For the greater part these countries can be filled in, in our broad picture, with a tone of brownish yellow, relieved here and there by splashes and long streaks of green. This vivid green vegetation often connects the dark green foliage of the mountain forests and the grassy slopes with the vast extent of yellow desert below.

THE LITTLE KNOWN LAND WHICH STANDS THREE MILES ABOVE THE SEA LEVEL

Let us now find these countries upon the map. On the east of the Pamirs is the high tableland of Tibet, between the Himalayas and the Kewen Lun Mountains. Tibet is more than four times as large as Arizona, and most of its surface, like the Pamir Plateau, is three miles above the level of the sea, with many peaks rising higher still. Eastern Turkestan, more than four times as large as Colorado, is bounded by the Hindu Kush, the Pamirs, and the Thian Shan Mountains, and the great desert. Much of the country is desert, and it is only along the Tarim river, and the few rivers that run into it that there is any cultivation of pasture.

The vast upland of Mongolia, of about the same area as Arabia, lies beyond the Thian Shan Mountains, and is bounded by Siberia and Manchuria. All these three countries of Central Asia have long been practically part of the vast Empire, now the Republic, of China.

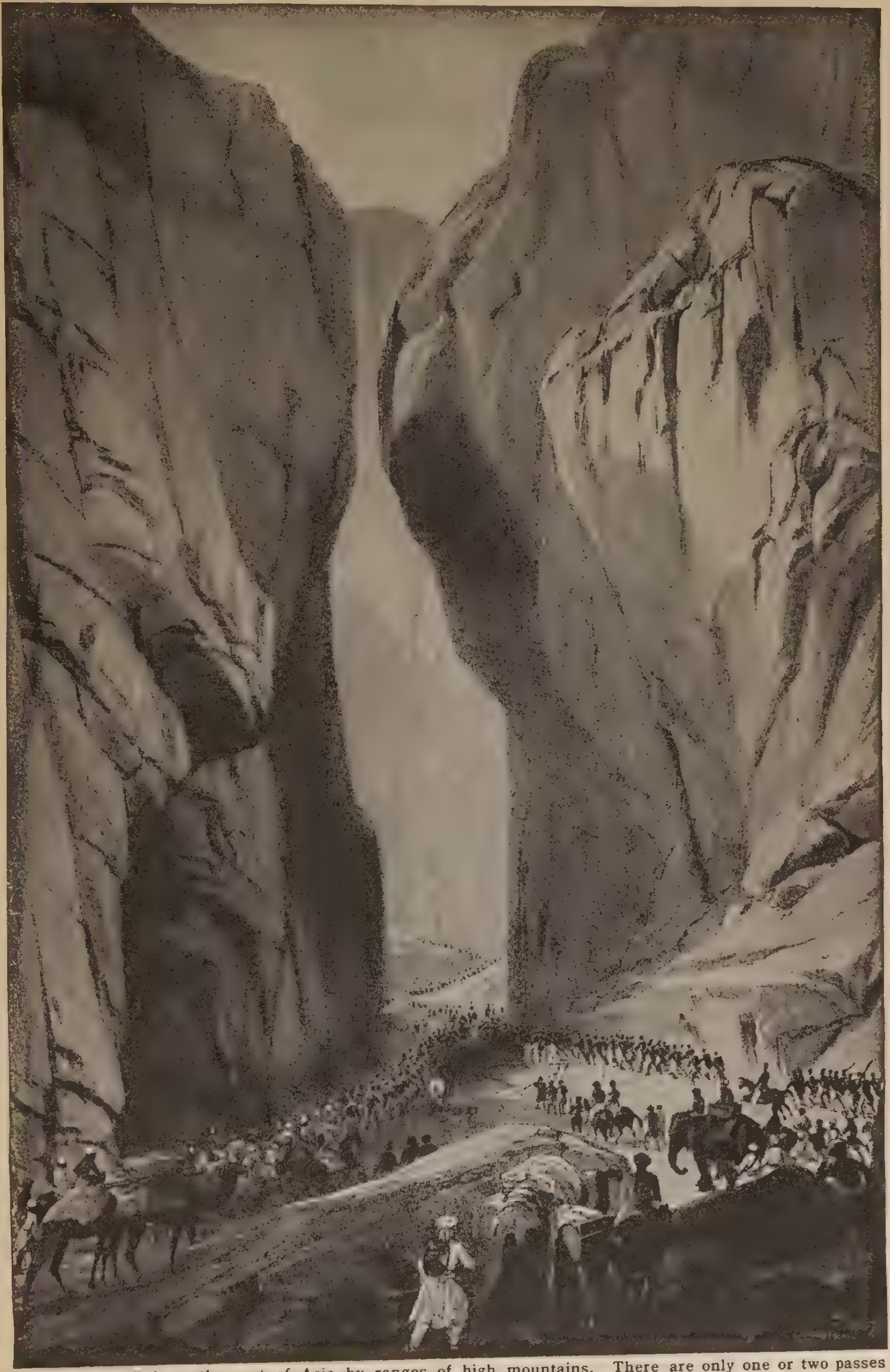
It is Afghanistan and British India that are chiefly concerned in the important passes to the south-west of the central plateau in the Hindu Kush and Suliman ranges. The fourth of the Powers whose dominions meet on the Pamirs is Russia. Two great rivers, the Syr Daria and the Amu Daria—Daria is the Persian word for river—flow from the heights of the Thian Shan and the Pamirs over the plain of Western Turkestan to the inland sea of Aral. Russian Central Asia stretches over these valleys from the Pamirs to Siberia, from the Caspian to the borders of Eastern Turkestan, nearly one-half the area of Canada.

WANDERING TRIBES & FERTILE VALLEYS IN THE GREAT DESERTS OF ASIA

We read in the story of Russia that begins on page 3797 how much of this vast country is desert, and how much consists of grassy steppes on which wandering tribes, such as the Kirghiz and Turcomans, raise immense flocks and herds. We may at the same time glance at the fertile oases and river valleys, with their fine crops of fruit, vegetables, grain, and cotton for the mills of Moscow and Warsaw. In parts of West Turkestan coal is found to be abundant, and it will be of great use as fuel for the railways and river and lake steamers of the district if ever the supply of petroleum refuse from Baku, which is now used, should fail.

Russian enterprise has brought the railway from the Caspian to the foot of the Thian Shan Mountains, linking together the towns situated on the oases and in the fertile valleys. One likes to think what the impetuous Tamerlane, who made his headquarters at Samarkand, would have thought of this rapid means of transit. A branch line is being made from Merv, the last

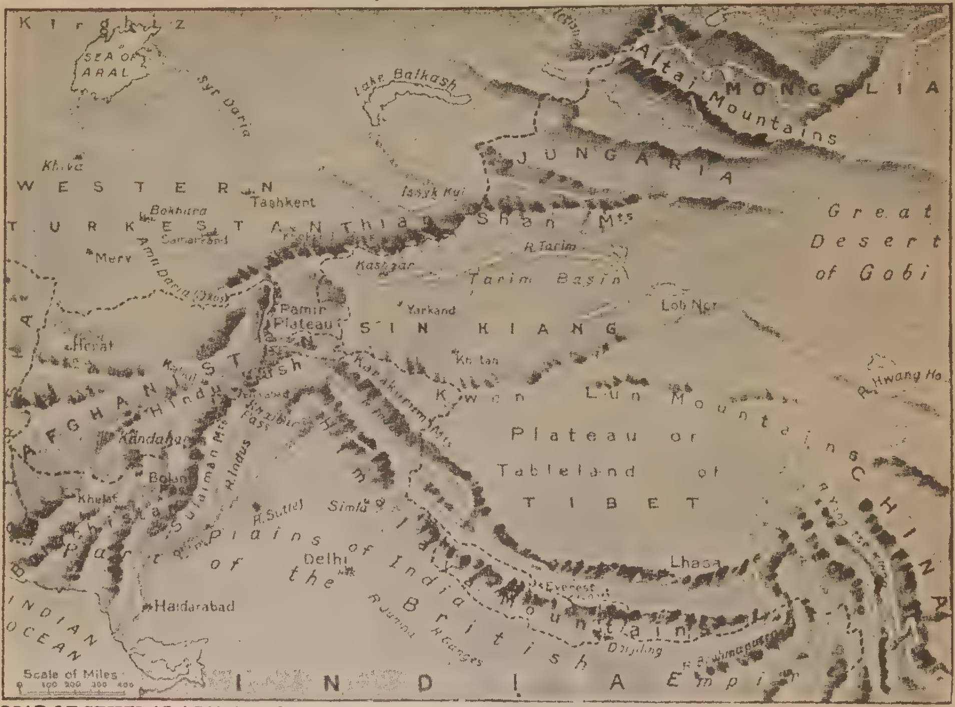
A MOUNTAIN PASS THAT LEADS TO INDIA



India is cut off from the rest of Asia by ranges of high mountains. There are only one or two passes through which she can communicate with the surrounding nations. This is a picture of the Bolan Pass, through which lies the route to Afghanistan. It shows the British troops marching through to Kandahar.

stronghold of the warlike Turcoman tribes, subdued by Russia in the middle of the last century, towards the Afghan frontier near Herat, to meet, in course of time, the British railway that is being made from India through the Bolan Pass, of which there is a picture on the preceding page.

Thus, far into the heart of Asia, the shriek and snort of the "iron horse" wakes the solitude and opens up possibilities of trade and travel on very different lines from those of old, which we can still study in Chinese Central Asia. The caravans of camels and ponies and asses, laden with goods, passing from one boundary to another, still toil over ancient routes from oasis to oasis, across deserts, by difficult mountain passes; and the intrepid explorers, to whom we owe most of our knowledge of this part of the world, make up their own caravans, taking their own provisions, boats, tents, maps—in fact, everything they need—along with them. It is very easy to perish of hunger and thirst in these parts of Central Asia.


Kirghiz
SEA OF ARAL
Syr Daria
Lake Balkash
Altai Mountains
MONGOLIA
JUNGARIA
Khiva
WESTERN TURKESTAN
Tashkent
Bokhara
Samarkand
Merv
Amu Daria (Oxus)
Issyk Kul
Thian Shan Mts
R. Tarim
Kashgar
Tarim Basin
Great Desert of Gobi
Pamir Plateau
Yarkand
SIN KIANG
Lob Nor
Herat
AFGHANISTAN
Hindu Kush
Kabul
Khaibar Pass
Karakorum Mts
Khotan
Kwen Lun Mountains
Hwang Ho
Kandahar
Bolan
Khelat
Suliman Mts
R. Indus
Plateau or Tableland of TIBET
CHINA
R. Sutlej
Simla
Plains of the
Delhi
Lhasa
Everest
Darjiling
R. Jumna
Ganges
Haidarabad
INDIAN OCEAN
British India Empire
Himalaya Mountains
R. Brahmaputra
Scale of Miles
0 100 200 300 400

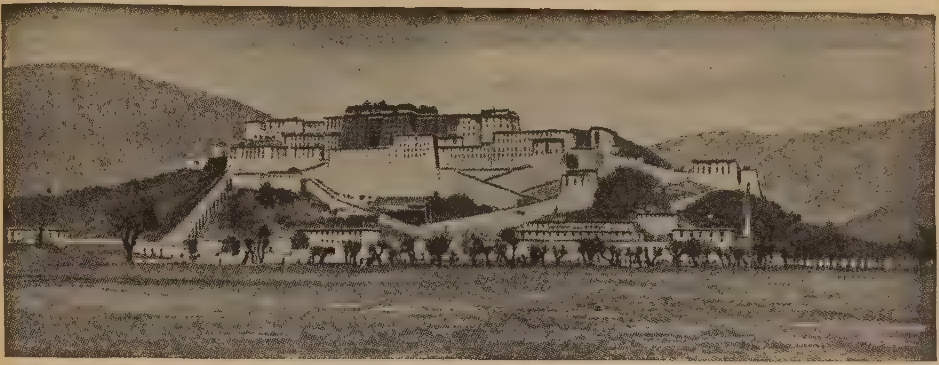
MAP OF CENTRAL ASIA, SHOWING AFGHANISTAN, TIBET, TURKESTAN, AND PART OF MONGOLIA

Let us start our travels in Mongolia, the vast grassy uplands lying between China and Siberia, and girdled by snow-topped mountains, whose lower slopes are covered by forests. The great Desert of Gobi, treeless and waterless, about 2,000 miles long, lies in its midst; and in the north-west the off-shoots of the Altai Mountains give rise to many rivers that make fertile valleys. The greater number of the people of Mongolia are shepherds, tending their great flocks and herds as their ancestors have done from time immemorial, and living much the same life that they have done through the centuries. But the Mongols have ever been irresistible warriors, too, as well as shepherds, when occasion and great leaders arose.

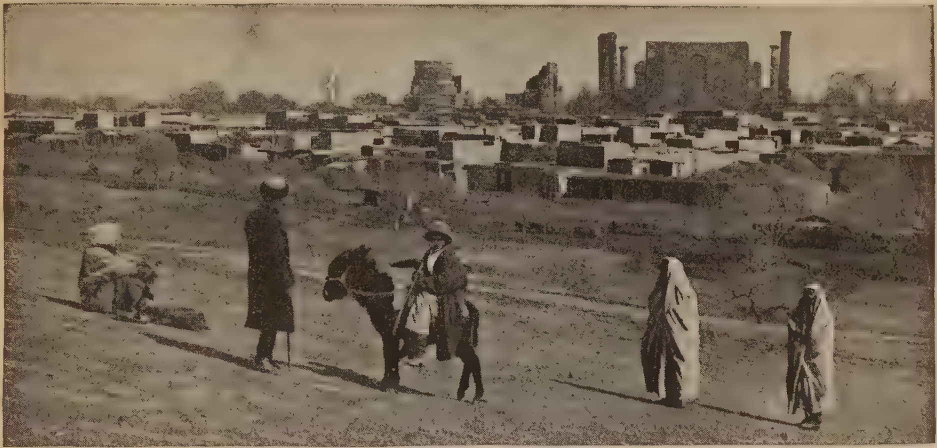
It was a branch of these people, called the Huns, who swept across from the south of Lake Baikal, round which the Siberian railway now circles, along the "Land of Grass," which stretches from the banks of the Amur to those of the Volga. We know how they terrorized the dwellers in Europe, till their great leader, Attila, was turned back at Châlons, not far from the Atlantic, in the middle of the fifth century.

Another branch of the Mongols, the Turks, who were settled near the rich metal-bearing Altai range, became for a time very powerful in Central Asia; and they, too, moved westward along

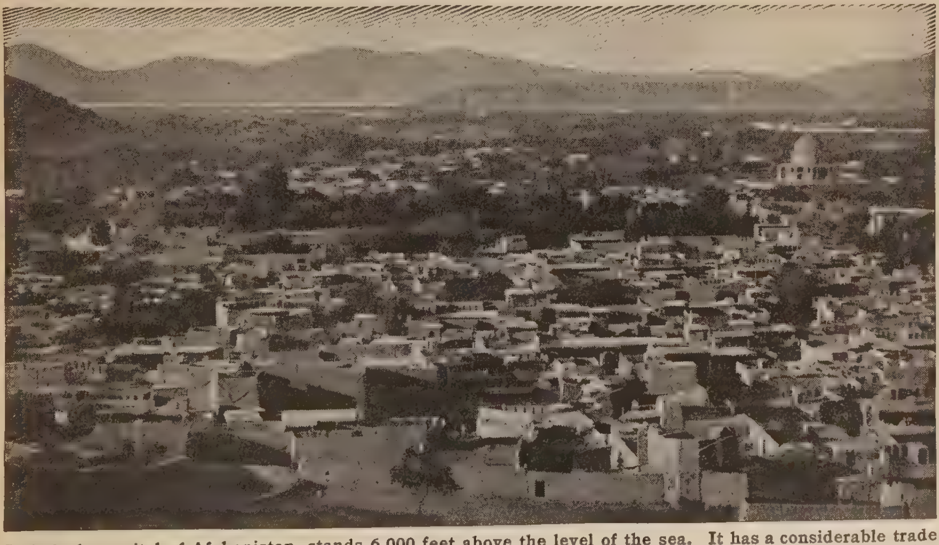
FAMOUS CITIES IN THE HEART OF ASIA



Not many years ago no such photograph as this existed; for Lhasa, which is shown in the picture, was the mysterious city of Tibet that no European was allowed to approach. Its name means the Home of the Gods, and it is here the Dalai Lama, or high priest of Buddhism, lives. A British expedition entered Lhasa in 1904.



Samarkand, which is in Russian Central Asia, existed before the time of Alexander the Great, who captured it during his conquering journeys. In 1369 it became the capital of another great world conqueror, Tamerlane, or Timur, who from it ruled his empire. The green stone used by him as a throne is still in the city.



Kabul, the capital of Afghanistan, stands 6,000 feet above the level of the sea. It has a considerable trade in carpets, shawls and silk goods, and the district round is noted for its fruit. It was from Kabul that Lord Roberts set out in 1880 on his historic march to Kandahar, where he defeated the Afghans.

the "Land of Grass," a few centuries after Attila. We know how strongly they influenced the history of Western Asia and of Europe. We also know how soon the Turks adopted Mohammedanism when they came in contact with it. This religion, simple and direct when it was first taught, has ever appealed strongly to the wandering tribes of Central Asia, most of whom, to this day, observe its customs, and devoutly say their prayers facing towards Mecca.

All through the early centuries advances were constantly made on Central Asia by the neighboring and ancient Empire of China, partly owing to the rise of trade, and partly through wars, in which sometimes the Mongols had the best of it and sometimes the Chinese.

When Jenghiz Khan, the "Perfect Warrior," arose early in the thirteenth century to lead the Mongols, he conquered not only the rest of Central Asia, but Persia and China too, though it was not till a century later that Mongol emperors were firmly established in China, where they ruled for a period of 200 years. After this the Mongols were driven out of China, and Mongolia then became a Chinese province.

THE CONQUERING HORDES OF TARTAR WARRIORS THAT SWEPT ACROSS ASIA

In the story of Russia we may read of the arrival of the Mongolian Tartars, on the north of the Black Sea, also of the arrival of succeeding hordes as the years went on, and of how strongly their influence stamped itself on the country for 300 years. This influence is felt to this day. We know, too, how Timur, or Tamerlane, burst with his destroying armies over Persia and India, and then far away to Asia Minor, where he arrested for a time the power of the Ottoman Turks. The story of the great Mogul power in India, in the days of the Tudors and Stuarts, is told on page 1716.

At the same time that these fierce Mongols were setting fire to all the world within their reach, and in many cases retracing their steps after two or three hundred years towards their original home, the old life on the steppes and the deserts was still going on. The patient camels were plodding along the old trade routes, with but temporary hindrance, carrying the silk from China, the precious jade stone from South Turkestan, the beautiful carpets, and soft hangings, and all the other treasures and riches of the East which made it seem a perfect wonderland to Western minds.

But the Westerns, as we shall see later, for many hundreds of years had no chance of traveling and exploring in the wide regions of Central Asia, as these regions fell more completely under the power of the Chinese Empire.

A MIGHTY RIVER THAT HAS NO MOUTH AND NEVER REACHES THE SEA

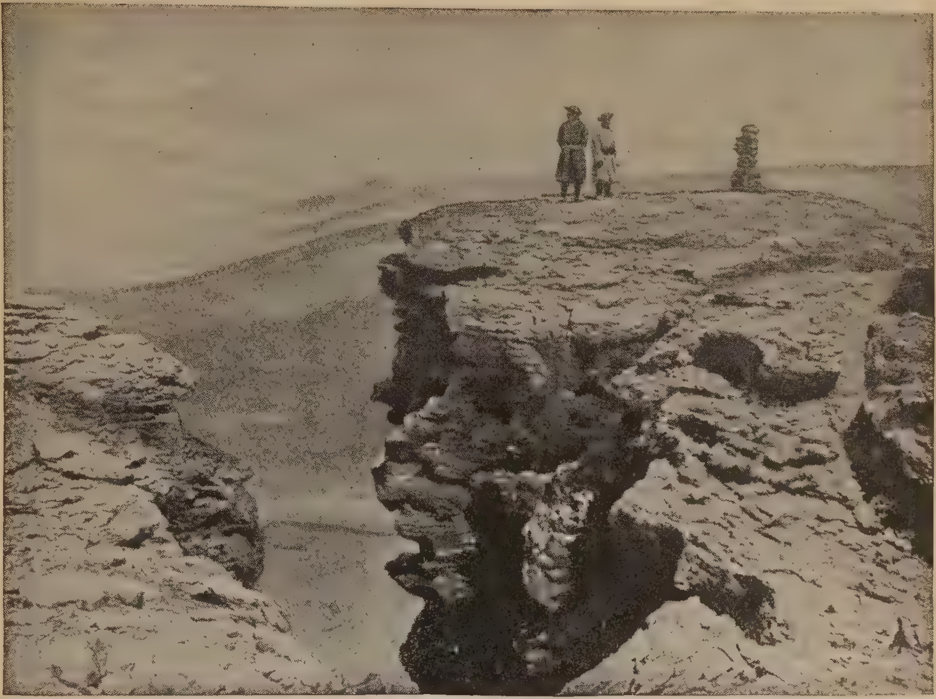
The two important towns of Kashgar and Yarkand, on the trade routes from China to India and Russia, lie at the western end of Eastern or Chinese Turkestan, where the streams come down from the heights of the Pamirs and make some cultivation possible in this wide and desert country.

The great Swedish explorer, Sven Hedin, spent much time in Chinese Turkestan, and to him we owe nearly all that is certainly known of the great River Tarim and its tributaries. Making his way over the outlying mountains of the Pamirs from the railway terminus of the Trans-Caspian line, he arrived at Kashgar while a great fair was going on. He soon pushed on to a town on the upper part of the river, and, after collecting native boatmen and stores and adapting a sort of house-boat, he started on his wonderful journey on the Tarim, a river as long as the Danube. Unlike the Danube and other rivers, the Tarim has no mouth and never reaches the sea, but dwindles away, after a long and winding course across a vast expanse of thirsty sand, in a system of shallow lakes.

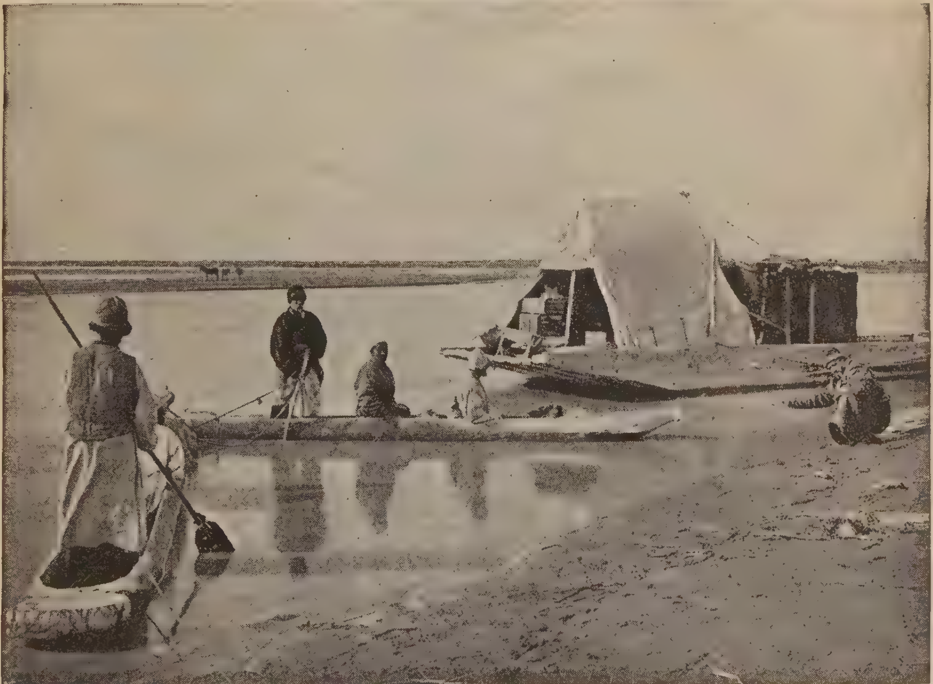
A FAMOUS EXPLORER'S LONG JOURNEY ON AN ALMOST UNKNOWN RIVER

Sven Hedin spent three months in his house-boat, drifting, paddling, and sailing, making observations and mapping out the winding course, as he noted the surrounding country. On the banks of the river and its tributaries was every variety of scenery. Women and children waded out to bring melons and other food for his use from villages amid cultivated fields; groves of trees delighted his eyes, some like enchanted forests with the gorgeous red and gold of the autumn leaves, the stillness being sometimes

MOUNTAIN AND PLAIN IN CENTRAL ASIA



The land of Tibet is about one-sixth the size of Australia, is enclosed by the loftiest mountains in the world, and is higher up than any other country of its size. It consists of great plateaus, and the average height of the country is said to be as great as Mont Blanc. This dizzy gorge is typical of Tibetan scenery.



Away from the mountains, the heart of Asia consists of vast deserts, cut up by rivers, and dotted with lakes that seem to be disappearing as the deserts extend. This picture shows the boats used by the people.

Reproduced, by permission, from Dr. Sven Hedin's "Scientific Results of a Journey in Central Asia."

broken by the flight of the wild ducks and geese on their way to winter quarters. Then came long stretches of pasture land, where lonely shepherds watched their flocks and fled terrified at the sight of the strange-looking tent-boat. It was the explorer's turn to be terrified when the green eyes of the tigers that came down to the river to drink, lapping like our tame cats, gleamed out of the darkness, and the tall reeds rustled and whistled in the breeze.

A RIVER THAT RUNS IN A DESERT BETWEEN HIGH CLIFFS OF SAND

All this time the sand that lay for an immeasurable distance on both sides, beyond the streak of cultivation brought by the river, was out of sight. Presently, however, it pressed forward and formed high banks like cliffs, between which the boat glided on her journey in dreary stillness.

The ice stopped the boat at last, for when the river froze, the explorer had to start on the equally exciting and more dangerous part of his journey by land. Then came the loading of camels with food, firewood and other necessaries, and choosing of horses and asses and dogs, with the help of the natives who acted as guides and companions. Day after day they wound their way for nearly 200 miles across the desert. Sand-storms, difficult climbing over the loose sand-hills, piercing cold that froze the ink in the explorer's pen, scarcity of provisions—all fell to their lot.

But many interesting facts were discovered or verified, such as the shifting of lake and river beds, the former existence of forests where nothing now grows, and, most wonderful of all, the explorer discovered that cities whose remains now lie buried under the penetrating, ever drifting and shifting masses of sand that cover everything, once flourished in this dry, silent waste.

THE JOURNEY OF A LITTLE ENGLISH BOAT OVER THE DESERT LAKES OF ASIA

We long to linger with Sven Hedin in his adventures among the wonderful lakes in the Lop Nor district where the Tarim is finally lost. He reached this district when the spring had brought scorching heat and mosquitoes—very hard to bear in the desert solitudes. With a little canvas boat from England he paddled over the wide lakes, some gleaming with fish and wild swans, some intensely salt and still, and bearing no sign of life whatever. But we must hurry on to cross the high passes of the north mountain wall of Tibet, some 2,000 feet higher than the tops of the highest mountains of Switzerland. Here we feel intense cold, as well as tremendously high winds, blinding snow-storms, and terribly rough paths. But the grand precipices and giant peaks are a fitting match for the southern rampart of Tibet—the glorious Himalayas.

The great Indian rivers, the Indus and the Brahmaputra, rise close together in the southern valleys of Tibet, and then flowing on, one west and the other east, break through the Himalayas in grand gorges more than a thousand miles apart on their southward search for the sea. The most fertile part of Tibet is in the upper part of these rivers, and of other rivers that flow eastwards to China. On the wide-swept, high plateau, dotted with lakes, the people rear large herds of sheep and mountain goats, and yaks carry burdens over the difficult and dangerous mountain passes.

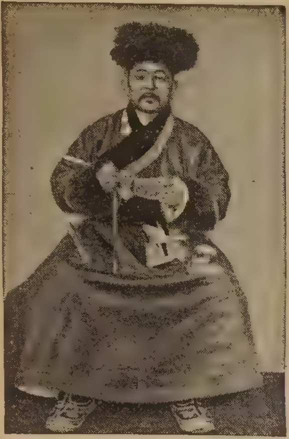
A LAND THAT IS GUARDED BY GLITTERING RAMPARTS IN THE CLOUDS

Tibet is one of the most extraordinary countries in the world, and its history and present state is chiefly owing to its position, that of a citadel strongly guarded by glittering, icy ramparts in the clouds.

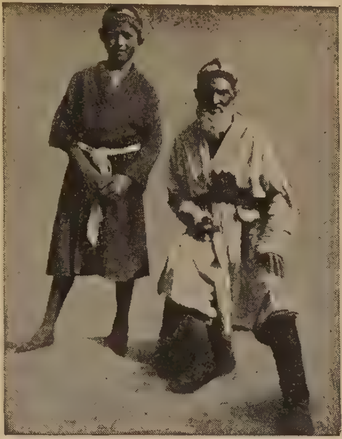
For a long time Tibet was little affected by the wars and migrations and changes that went on in the rest of Central Asia. From hunters its early people developed into herdsmen, with yaks to carry their loads as they wandered about. Later they began to cultivate the soil where rivers made it possible, and as they became more civilized their power grew so much that they became formidable enemies even to China.

In the meantime a wonderful invasion was taking place in Tibet, and, indeed, it is the only one that has really mattered in the country's story. That ancient and wonderful religion of India, Buddhism, spread by slow degrees over Tibet, and in the course of time, as its influence lessened in India, it increased in Tibet, till at last that isolated and mysterious country, of which the outer world has always known so little,

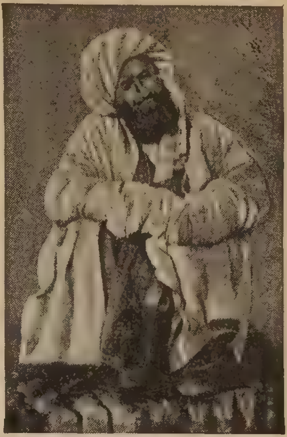
THE PEOPLE WHO LIVE IN CENTRAL ASIA



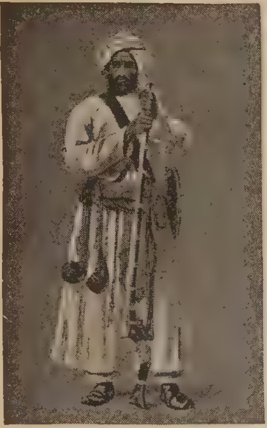
The present inhabitants of Mongolia are wanderers, like their ancestors. Here we see a wealthy Mongol gentleman.



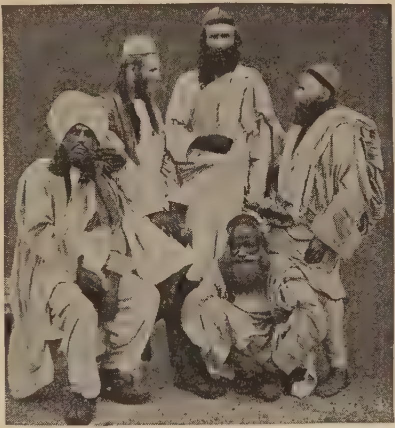
These are Sarts of Russian Central Asia. The word Sarts is used for the settled people, agriculturists and traders, as distinct from the nomads.



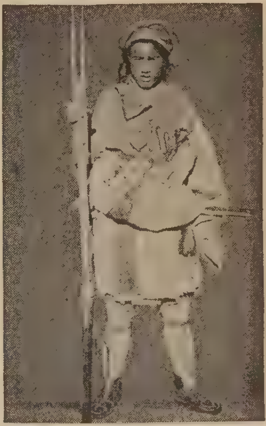
A rich Turcoman of Bokhara, where wealth consists chiefly of sheep, goats, and camels. The Turcomans were once brigands.



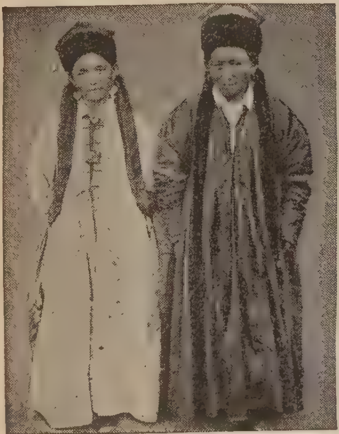
The Afghans are a fierce warrior race who dislike living within the towns.



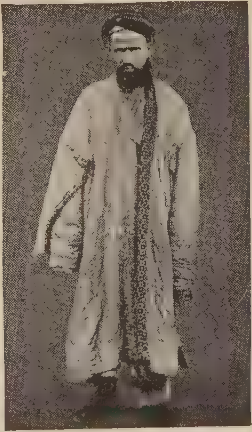
The Beloochis are a tall, daring race, although lazy, and much given to bringandage. They almost always go about well armed.



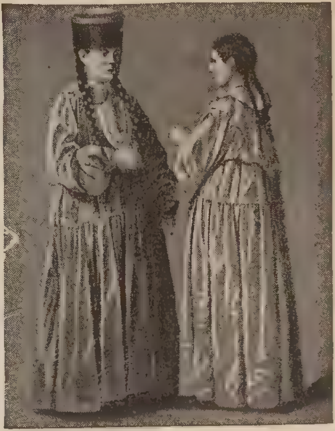
This is a native soldier of Tibet armed with a curious flint-lock gun common in the country.



These girls are Kalmucks of Russian Central Asia, a Mongolian race of nomads, found also in considerable numbers in the Chinese Empire.



Here we see a Dervish of Samarkand, the once famous capital of the great Tamerlane, who is buried there.



Women belonging to the Tartar tribes living in Russian Central Asia. This race came from Chinese Tartary, and were formerly great conquerors.

became its chief headquarters. Naturally, Tibet shared to some extent in the convulsions that shook the old empire to which it was eventually attached; but, outside, worldly matters seemed to pass unheeded by the Tibetans as they became more and more absorbed in their religion and its observances.

HOW THE BRITISH ENTERED LHASA, THE MYSTERIOUS CAPITAL OF TIBET

Many travelers have of late years been turned back from its borders, for the Tibetans share the Chinese dislike of foreigners. However, a British force, sent to settle some trade arrangements, succeeded in entering Lhasa, the capital. Under a new agreement, a British agent now lives in the country, and may, if he thinks it necessary, visit Lhasa with his escort. Tibet is ruled by the Dalai Lama, through a regent, who is assisted by five ministers. Tibet belongs to China in name, but China has really no power over it.

Thousands of Buddhist pilgrims from China and India wend their way to worship at the holy city of Lhasa, and to reverence the Dalai Lama. He lives a short way from Lhasa, in a mysterious, huge white palace on the crest of a hill, the centre part a blaze of crimson, the roofs of glittering gold. Who can tell of the treasures inside, brought by the devout pilgrims from the rich East?

It is said that in Tibet there are 20,000 priests, or monks; in one monastery alone, near Lhasa, there are 6,000. Every family dedicates at least one son to the priesthood. This being the case, it is scarcely to be wondered at that the spirit of devotion to the religion of Buddha has very deeply influenced the Tibetan people, who have so little intercourse with the outside world, that holds such different opinions from their own.

A LAND OF MANY PRAYERS WHERE MEN WORSHIP BY MACHINERY

Religious inscriptions are seen on the rocks, houses, and temples; prayer-wheels, such as those to be seen in the Room of Religions in the British Museum, turned not only by hand, but by wind and water, reel off prayers to the Deity amid the flutter of praying-flags. When the day is ending, and the dark rocks stand out grim against the sky, all work stops, the people gather in the squares and open places, and, prostrating themselves on the earth, chant the evening prayers. Very different has been the story of Afghanistan, on the other side of the Pamirs. Through the Khaibar Pass, thirty-three miles long, and in parts only ten to seventy feet wide, many conquerors have marched to the rich plains of India, and there have been numerous fights and struggles about other passes and the chief towns—all keys to India—as well as stations on the old caravan routes to French Indo-China and Persia.

Afghanistan has had its share in all the devastations and conquests of the centuries, for Arabs and Turks and Mongols have swept across it in turn. For a time, as we know, its Mongol rulers were supreme both in Persia and India; then their power ebbed again, and the hardy Afghan mountaineers became independent once more in the middle of the eighteenth century.

The British have bitter memories connected with many of the towns and passes. In 1842, a British army of 4,500 men, with 12,000 followers, left Kabul to retreat to India through the snowy passes which it commands. One man alone survived the constant attacks of the Afghans and the hardships of the way, and stumbled into Jellalabad on his exhausted pony, fainting, and hardly able to tell of the disaster and the fate of his companions. Of this large army 690 were Europeans; the rest were Asiatics.

THE FAMOUS MARCH OF LORD ROBERTS FROM KABUL TO KANDAHAR

In August, 1880, Lord Roberts made his famous march in twenty-two days from Kabul to Kandahar to restore order after the risings and losses following the settlement of the frontier boundaries.

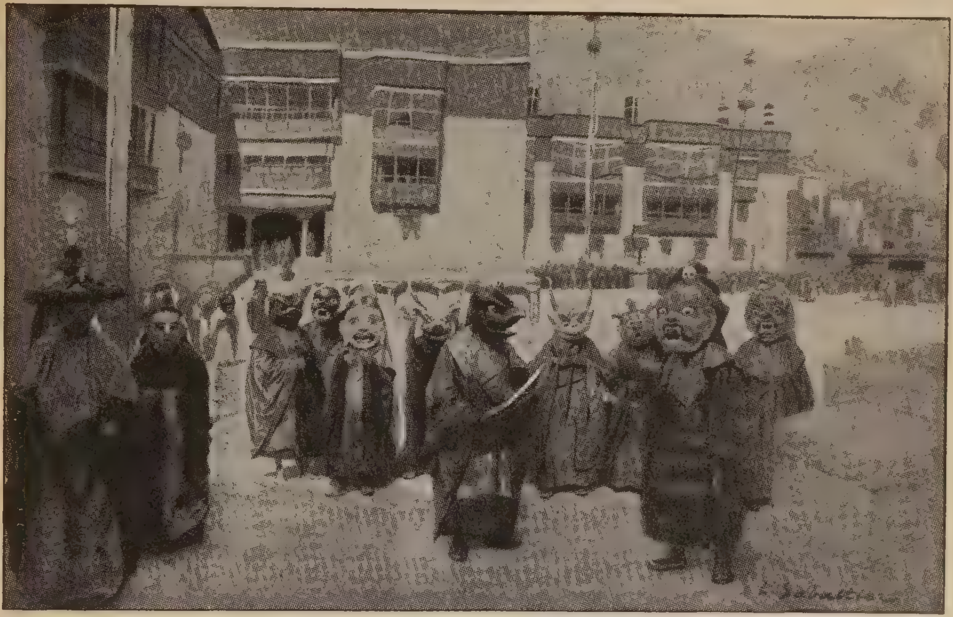
If we turn to page 60, we can read the story of Marco Polo, the Venetian boy of fifteen, who walked to China in the thirteenth century. He was twenty-one when he reached the end of his journey. It will interest us to trace his route, for we, too, have crossed Syria to Mesopotamia and Baghdad, and found our way to the Persian Gulf. We have wandered, too, round the mountains and deserts of Central Asia. After a stay at Ormuz, finding it impossible to go on by sea, the boy, with his father and uncle, went north through Persia and Afghanistan.

Here the party had to rest awhile on account of Marco's illness; he greatly enjoyed the fine mountain air and scent of the pine-groves as he was getting better. Then, by the upper courses of the Amu Daria, formerly called the Oxus, the party pushed up to the Pamir Plateau itself, and then descended on Kashgar, Yarkand, and Khotan. The Tarim basin was next crossed to Lop Nor. Finally, by the route to the north of China, the city of Peking was reached at last. These regions were closed to foreigners soon after this wonderful journey, and they were not described again by Europeans until six hundred years had elapsed.

We have found much to think over while looking at the map of the heart of Asia, and while following the footsteps of the brave travelers who have faced its mysteries and dangers. We have realized, too, whence came the streams of conquerors into Europe—the conquerors whose names and deeds and personal appearance are familiar to us. And yet we have still many questions to ask.

What of that dim host that, in the distant past, spread over India and Europe and left traces of their ways of life, and of their thoughts, in words that have been handed down through countless generations? Where was their first home, and why did they leave it? No one yet knows, though explorers and lovers of the study of Mother Earth's secrets, and of the languages spoken by her children, are all trying to find out. They say that perhaps a great open sea once glittered in the sunshine, where the vast plains of Siberia now lie in swamps, with great salt inland lakes, such as the Caspian and Aral, that were left behind when the rising land pushed the ocean ever farther north. The wooly mammoths imprisoned in the ice tell of such mighty and overwhelming changes. So, perhaps, what is now the dry and sandy heart of Asia was once a forest-covered seaside land, tempered by refreshing breezes that brought rain and moisture to a country that was not nearly so high as the "Roof of the World" is now. For when the bed of the northern ocean rose, the mountains and plateaus may have been pushed up, too, so that river basins and courses were completely altered, and the climate, instead of being pleasant and temperate, became one of great extremes in heat and cold.

Perhaps it was changes such as these that may have driven the early peoples of what is now Central Asia to the plains of India, and ever farther across Eurasia towards the lands of the setting sun.

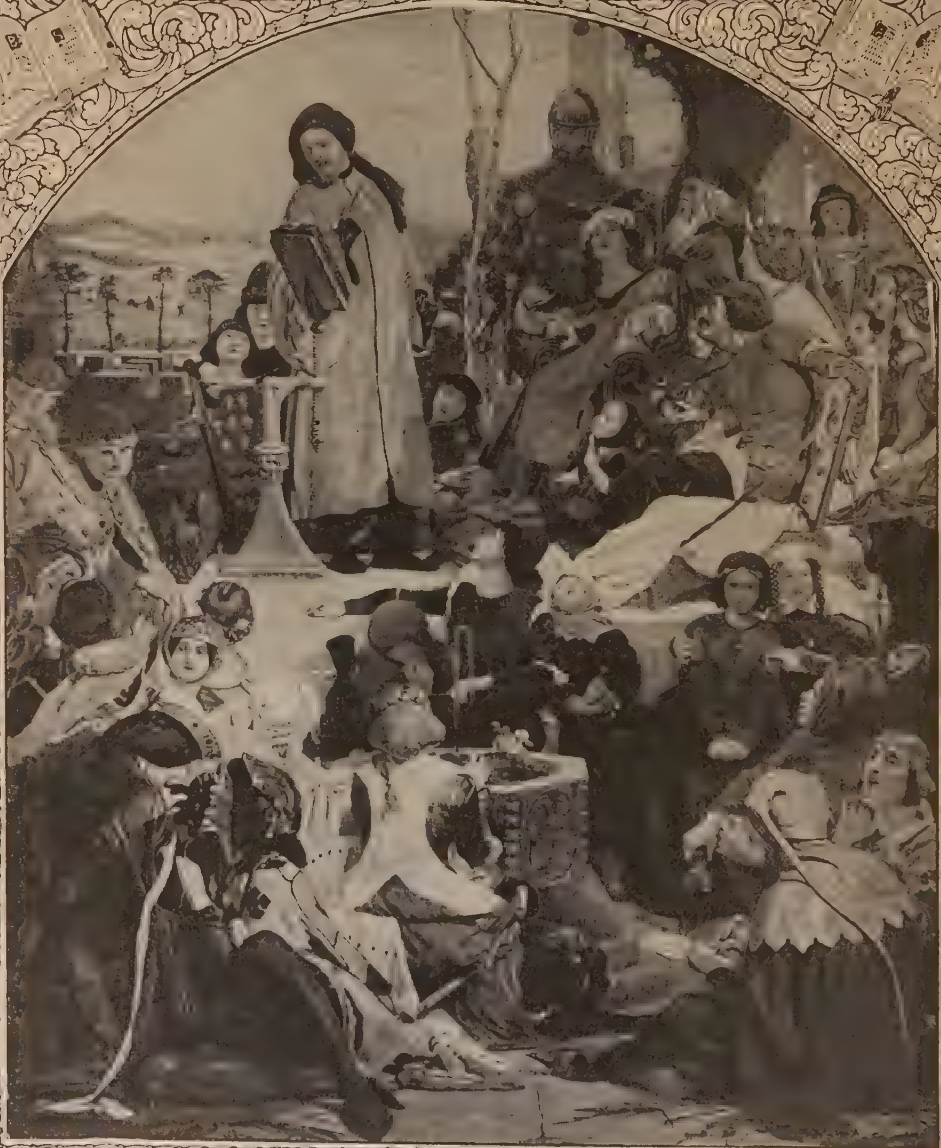


This strange scene is to be witnessed at the beginning of spring all over Tibet. The country is full of monasteries, and at the religious festival of spring the lamas, or monks, wear strange and hideous masks, in striking contrast to their gorgeous silk robes. The monastery in this picture is the famous one at Himis.

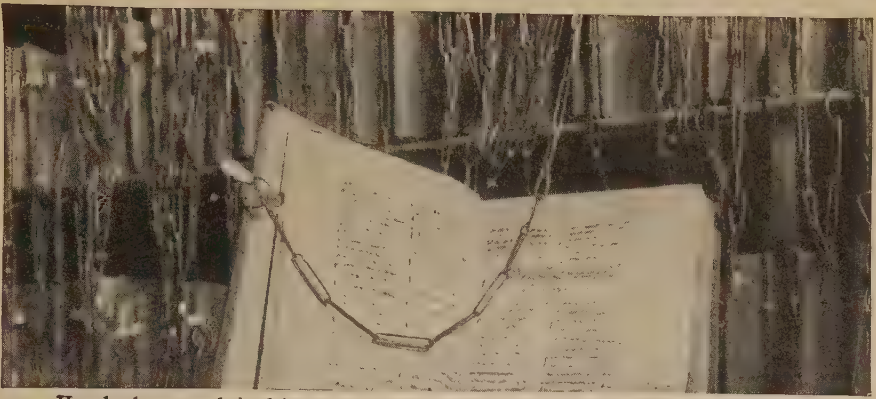
THE NEXT STORY OF COUNTRIES IS ON PAGE 4077.

THE FATHER OF ENGLISH POETRY

GEOFFREY CHAUCER READING POEMS FROM HIS CANTERBURY TALES AT THE COURT OF EDWARD III.



Chaucer, the first great English poet, lived in the 14th century, before the days of printing. The poet was a favorite at the court of King Edward III., and at times would read his poems before the king and his courtiers, in the way which Ford Madox Brown, the celebrated painter, has illustrated so happily in this picture.



How books were chained long ago, as still seen in an old library at Hereford Cathedral.

MEN WHO FIRST WROTE ENGLISH

HOW THE FIRST ENGLISH BOOKS FIXED THE LANGUAGE

CONTINUED FROM 3772

WHEN we speak of Chaucer as the "father of English literature," we do not of course mean that he was the first writer known in England. We simply mean that, although many men wrote English before his time, he was the first great author who wrote in English that we can read with ease and pleasure.

In the BOOK OF STORIES we read the fine story of Beowulf. This is the first English poem that we have. It was sung in the banquet halls of England long before the great king Alfred reigned. We have a manuscript copy of this poem, which was made perhaps about King Alfred's time, but it was written in what is known as Anglo-Saxon or Old English.

Bede, whose story we read elsewhere, translated the Gospel of St. John into English. He also wrote a charming history of the English nation to his own time, about two hundred years before King Alfred lived. The history was written in Latin, but it is as easy for us to read the book in that language, as it is to read the translation which King Alfred made into the English language, as it was spoken in his southern English kingdom of Wessex.

Alfred, who was not only a great king, but a good writer and a great educator, spent his leisure moments in writing and translating books, so that his people might have books to read in their own language. It was this great man who gave instructions for the record of events called the Anglo-Saxon Chronicle, which was written in the monasteries. Records were made in it until after the Norman Conquest, and though the entries are short, it has helped us to learn the history of the time.

After Alfred and the writers of his time had died, there is a blank in English literature. The attention of the men of the next century and a half was occupied with the struggle with the Danes. Then came the Norman Conquest, and for a long time the English language was looked upon with disdain, as the tongue of a conquered people.

But we are mistaken if we think that *no* literature was produced in English, through books or by word of mouth, during those fierce and turbulent times. In the monasteries patient monks, proud of their skill as penmen and painters, were busy with the chronicles of their day. Tale-tellers

Copyright, 1918, by the Grolier Society.

or harpers wandered about the country from hall to hall, from fair to fair, and from inn to inn, singing or reciting ballads new and old for the amusement of their hosts or companions. Plays, clumsily made from Scriptural incidents or romantic adventures, were acted by the peasantry, or by guilds of workmen in the towns, and thus old-time legends were preserved and extended, together with the doings of kings, religious instruction, and songs, lively or sad. In this way, though no great writer lived in these centuries, simple forms of literature were circulated.

The popular tales of the time passed from country to country, and were recast, added to, and ornamented as they traveled. English and Welsh stories were written down in France and then brought back into England, or were turned into Latin by monks. Four or five sets of these stories can be distinguished—the Greek accounts of the siege of Troy, the adventures of Alexander the Great, the heroic deeds of King Arthur, the history of Charlemagne, and later the greenwood adventures of Robin Hood. France was the great workshop for tale-making, and French the language of romance. French was made the language of the palace, the castle and the law court. French, not English, was taught in the monasteries, which were the schools of the time. Gradually the native language suffered change. Grammatical forms were altered. The use of many French words crept in, and the English of the fourteenth century had become so different from the old Saxon English that King Alfred could not have read it.

GEOFFREY CHAUCER, WHO FIXED THE LANGUAGE THAT WE SPEAK

But all the while, English remained the speech of the great bulk of the people. The descendants of the Norman barons, who prided themselves on being English, began to look upon the English language as their own.

Slowly one of the dialects of English—the East Midland, which was spoken in London—gained the mastery, and began to be regarded as standard English. The English kings ceased to feel as Frenchmen. English was spoken more and more by all classes. It was again made the language of the courts of law. Poets began to write in it. The time had come for some one to establish for ever the language, by using it in books that all men would read. The man who did this work was Geoffrey Chaucer.

Chaucer was born in London, by the side of the Thames, but *when* is one of the puzzles of history. For centuries the date was believed to be 1328, but more facts keep coming to light, and now we know it could not have been 1328, but probably was 1340, or thereabouts. We know this because in 1357 Chaucer was page to the wife of Prince Lionel, son of Edward III, and she spent about twenty-five dollars of our money to buy him a suit of clothes, including a pair of red and black breeches.

THE BOY WHO GREW UP TO BE REMEMBERED FOR EVER

Chaucer was just the man to write poems picturing all the different kinds of people living in his day, for he saw much of the world. His father, a wine merchant, was connected by business with the king's court. As a boy the poet had a sound education, to which his experience as a page added manners and a gentle bearing. While he was yet in his teens he went to France with the army of Edward III, and was taken prisoner, but ransomed. The king himself paid a part of the cost.

Six years later Chaucer was one of the "valets of the king's chamber," and afterwards, when between thirty and forty, he crossed to the Continent seven times on the king's service, and once remained in Italy nearly a year. At the height of his prosperity the poet sat in Parliament, but his fortunes declined with those of his faithful friend John of Gaunt.

Chaucer was not only a man of learning, but a man of the world, trusted by the greatest of his day, and a traveler of wide experience. His writings show the influence of his travels. At first he translated and imitated the French poets. Then he was captivated by Dante, the greatest poet of the Middle Ages, and by Petrarch, whom he probably met in Italy. But though his later poems often borrowed both their form and their subjects from Italian works, they became increasingly English in thought and original in treatment.

CHAUCER'S PICTURES OF HIMSELF IN HIS POEMS

Before asking what kind of man this Chaucer was in appearance; let us learn how to read his verse—an easy matter if we notice two or three points.

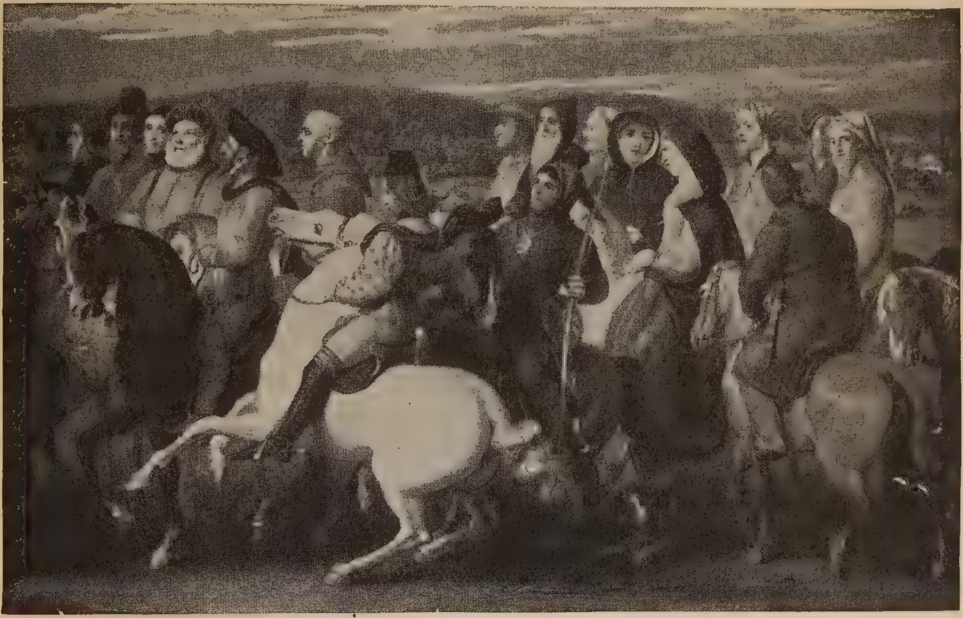
Some of his words have passed out of use, or have changed their meaning, and we may have to look for their old meanings in a glossary. Many words were spelled out more fully than now, and had an extra syllable—as *newë* for new, *bookës* for books, and *gamë* for game. Then words borrowed from the French kept the emphasis on the last syllable, as rea*son* for reason, and vir*tue* for virtue. Also *tion* endings are not pronounced as *shon*, but in the French way, as if they had two syllables and were spoken *ce-on*. On this page you will find some extracts from his poems, which show that by taking a little trouble, we can read them for ourselves.

In his writings Chaucer has outlined a picture of himself, and we can fill it in from other personal jottings. Stout in body, pleasantly roguish in face, quiet and retiring, though a man of the world, his bright eyes see everything.

Though a student deeply in love with books, he is no hermit, but takes cheerfully whatever life comes to him among his fellow-men, and thanks God for it. He cannot resist the chance of poking quiet fun even at men whom he admires. His best mood comes in response to the call of spring. Then he goes out of doors, and is charmed by the flowers, and the small birds. Most of all, he loves the modest daisy. Nothing but death, he says, can take the love of this flower from his heart.

This is how this gentle writer is invited to step forward and show himself among the pilgrims of his "Canterbury Tales."

"Thou lokest as thou woldest finde an hare,
For ever up-on ground I see thee stare.
Approche neer, and loke up merily.
Now war yow, sirs, and lat this man have place;
He in the waast is shape as wel as I;
This were a popet in an arm t'enbrace
For any woman, smal and fair of face.
He seemeth elvish by his contenaunce."



The Pilgrims on Their Way to Canterbury—the Last Rider is Chaucer.

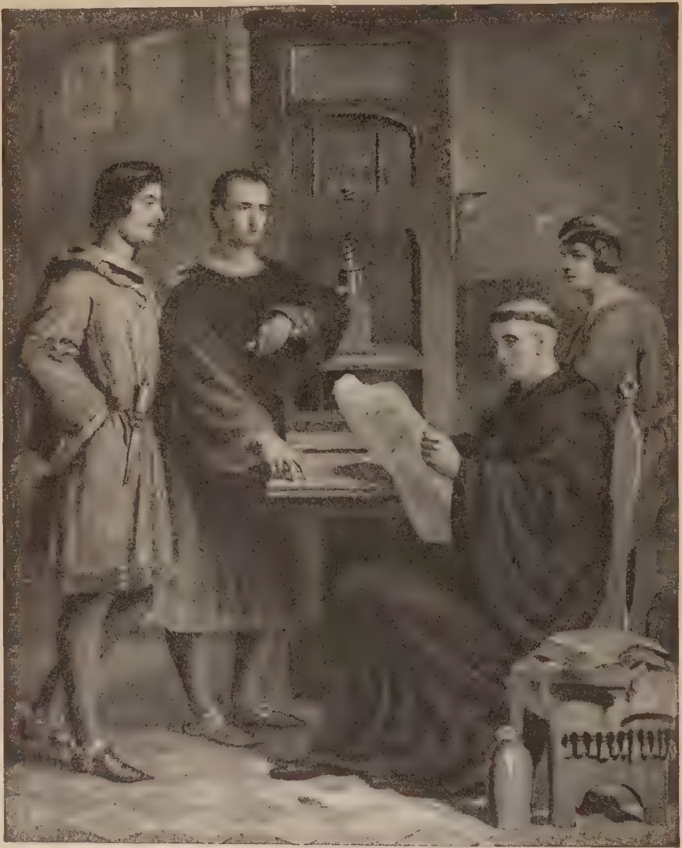
In another poem he is described as buried in his books when his day's business is over.

"But of thy verray neyghebores,
That dwellen almost at thy dores,
Thou herest neither that ne this;
For whan thy labour doon al is,
And hast y-maad thy rekeninges,
In stede of reste and newe thinges,
Thou gost hoom to thy hous anoon;
And, also domb as any stoon,
Thou sittest at another boke,
Til fully daswed is thy loke,
And livest thus as an hermyte,
Although thyn abstinence is lyte."

Below Chaucer again views himself among his books. Remember that *lyte* means little, *foules* means birds, and *war yow* means make way.

"So hertely, that ther is game noon
That fro my bokes maketh me to goon,
But hit be seldom, on the holyday;
Save, certeynly, whan that the month of May
Is comen, and that I here the foules singe,
And that the floures ginnen for to springe,
Farwel my book and my devocioun!"

The poet's writings fill seven hundred pages of close print, but the poems that picture him for us at his best are a collection called "The Canterbury Tales," which he had not finished when he died.



Caxton Showing Book to the Abbot of Westminster

The plan of these tales gave the poet freedom to choose characters from the rich, the middle classes, and the poor, and bring them together under circumstances that made them friendly, yet left them natural and independent.

A company of about thirty men and women, the poet imagines, have met on an April day at the Tabard Inn, in Southwark, over the Thames from London, to start on a pilgrimage to the tomb of Thomas à Becket at Canterbury. They made a merry group, bent on enjoyment as well as religious duty; and the landlord of the inn, a jovial, managing fellow, volunteers to act as their guide. To pass the time pleasantly as they travel on horseback at a walking pace, he proposes that each pilgrim shall tell two stories on the way to Canterbury, and two on the return journey. Whoever tells the best story, the landlord being the judge, is to be entertained at supper by the rest of the company when they return to the Tabard. The poet describes each of the pilgrims, and writes the stories they tell, but only twenty-four. Before they reached Canterbury the tales broke off, owing to the poet's death, and we do not hear which story won the prize.

In these tales, supposed to be told by all kinds of people, the manner in which people lived in the Middle Ages is unrolled before our eyes like a vast panorama. We see it just as it was, sometimes gentle and romantic, sometimes brutal, cunning, and vulgar, with good and evil so mixed that we do not know whether to laugh most or lament most at the sight. You can feel that Chaucer greatly enjoyed telling these stories, for all the while he was full of fun and high spirits. He could not help making fun of himself, as when called forward to tell his own story, he started a long, romantic rhyme of love, "Sir Thopas," such as he had in his youth translated from the French, and the landlord stopped him abruptly by exclaiming, "No more of this!"

What a mixed company it is that gathers under the guidance of the jolly innkeeper! There is the knight, who has ridden through many lands to fight for love and chivalry and honor, freedom and courtesy, and who yet, in his bearing, is "as meek as is a maid." With him is his son, a curly-headed lad of twenty, his dress as gay as a flower garden, his mind full of love and romance, but not in sadness, for—

"Singing he was and fluting all the day,
He was as fresh as is the month of May."

As a squire the young man has "borne him well" in France and the Low Countries, and, like the knight, is a gentleman in heart and bearing.

"Courteous he was, lowly and serviceable,
And carved before his father at the table."

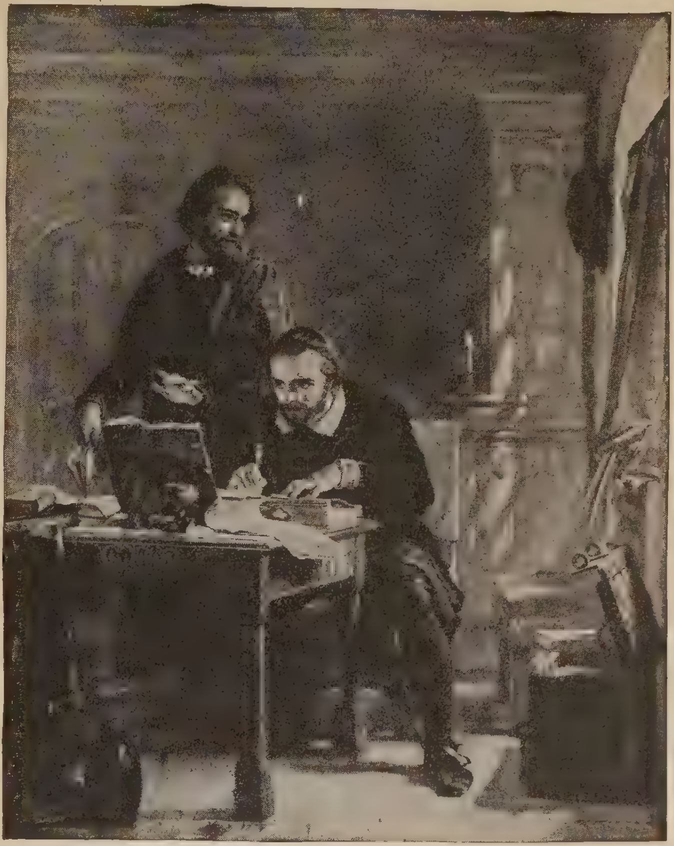
The knight and squire are attended by an honest yeoman, bow in hand. The Church contributes a group of characters, the chief among them being a prioress, who is a model of the best manners of the day, eating with cleanness and delicacy, and wiping her lips carefully "when she drunken hath her draught." Besides, there is a worldly-minded, sport-loving monk; a wandering friar, the best beggar in the whole countryside; a red-faced tax-collector; a pardoner; and a devoted parish priest, who, staff in hand, walks in all weathers from end to end of his parish, visiting great and small in their sickness, teaching Christ's Gospel, "but first he followed it himself." Though poor, this parson is "rich in holy thought and work."

"Benign he was and wonder diligent,
And in adversity full patient,
To drawen souls to heaven by fairness,
By good example was his busyness."

The professions provide a doctor, with more than a suspicion of quackery in his talk; a lawyer, who is not so busy as he tries to appear; and a pale, threadbare student from Oxford, who would rather have books than gay clothes. His mind is bent wholly on study, and he speaks with well-formed sentences.

"Sounding in moral virtue was his speech,
And gladly would he learn and gladly teach."

The landed classes sent to the pilgrim group a farmer; commerce sent a merchant; and among the rest were a miller, a ploughman, a sailor, a carpenter, a weaver, a dyer, and a wife of Bath, who had been married five times. The whole range of manners of the times, of good taste and of bad taste, is covered by these living figures.



Tyndale Translating New Testament into English

Most of the tales were borrowed from Italian writers, but in turning them into English Chaucer gave them freshness and even new meanings. Good nature and a quiet humor played over all his writing, but he taught serious natural duties like contentment:

"Look up on high, and thank thy God for all," and a still loftier duty of faithfulness to the best thoughts that visit us:

> "Hold the high way, and let thy soul thee lead."

Caxton, who printed books in the English tongue seventy-seven years after Chaucer's death, printed some of the poet's works seventy-eight years after his death, and introduced them by saying: "We ought to give singular laud (praise) unto that noble and great philosopher who may well have the name of laureate-poet." With that judgment all later users of the English language agree, for Geoffrey Chaucer not only wrote pleasant poems, but pictured the people of his own day, and helped to fix our tongue, which had been changing constantly.

THE TALES TOLD BY THE COMMON FOLK

While Chaucer was writing poems for fashionable people to read in expensively copied books, the common folk were telling each other tales in ballads—simple rhymes, often stumbling along. Then again they move our hearts with strong, clear picture-words, or haunt us with recurring phrases or refrains. When printing was invented these ballads were among the first poetry circulated everywhere, and one set, that told the story of the bold outlaw Robin Hood and his merry men, was so well known that a poet, Michael Drayton, writing a century later, said of Robin:

> "In this our spacious isle, I think there is not one
> But he hath heard some talk of him and Little John."

We can read, as an example, the ballad recording the tradition that Robin Hood was bled to death, when ill, by a treacherous kinswoman, the prioress of Kirklees, or Kirkley, nunnery. It shows how limping the metre often was, and yet how sad, how vivid, and how powerful the simple verses became when feeling was strong in them.

VOIAGE AND TRAVAILE OF SIR JOHN MANDEVILLE

There were other writers of English about Chaucer's time of whom we shall speak, but first we must go back to a very famous book, the "Voiage and Travaile" of Sir John Mandeville. This book, however, was not written in English. It was written in French about the time that Chaucer was a page. For centuries people thought that the book had been written by an Englishman, Sir John Mandeville, but scholars now tell us that it was written at Liege by a man whose name was Jehan de Bourgoyne. He was generally known as Jehan a la Barbe, and was probably a physician. He may not have been an Englishman at all, but it is possible that he was, and that he had to go into exile for a political offence. It is certain that the author of the book had been a great traveler for his time, and that he had been in Egypt. For a long time, it was thought that the author himself translated his book into English, and although we do not now think that he did this, we still speak of it as an English book, for it was translated by some one, probably in the lifetime of the writer, and certainly in the lifetime of Chaucer. It is a marvelous account of travels in Egypt and Asia, and describes some things that the writer saw, some he could only have heard or read, and many things that he believed or imagined, but which never existed. It is thought that he died only a few years before the death of Chaucer.

JOHN GOWER, WHO LIVED WHEN CHAUCER DID

John Gower, who was one of Chaucer's friends, was a writer of English when Chaucer was a youth. He was probably about ten years older than Chaucer, and as he lived about eight years after Chaucer's death, he was an old man when he died. He was not a genius like Chaucer, and his poems are not interesting to every one, but he wrote good poetry, and always placed himself on the side of right. He too helped to settle the form of the English language, a work that had already begun before his time, although it was not finished until about Shakespeare's day.

Gower was born about 1330, and died in 1408. In his youth he wrote in French and Latin, but in his later years, he wrote in English.

It is possible that Chaucer also knew John Wycliffe, for Wycliffe lived under the protection of John of Gaunt. John Wycliffe was born in Yorkshire about 1320 and died in 1384. He went to Oxford University, where he studied at the famous Balliol College, and became a priest and, for his time, a very learned man. He was noted in his early days as a philosopher, and is famous in history as the man who may be said to have begun the movement which is known as the Reformation of the Church. He wrote sermons and tracts on the state of the Church, and his writing is chiefly of interest to students of history and English literature. But he was one of the writers who, in the fourteenth century, helped to accustom people to read in their native tongue, and so helped to create a demand for books in English. As we have learned on page 773, Wycliffe probably directed the first full translation of the Bible into English, and it is probable that he translated some of it himself. No fewer than 170 manuscripts of his version are still in existence.

THE VISION OF PIERS PLOWMAN

A very famous poem has come down to us from Chaucer's time, of which we must not forget to tell. This is the "Vision of Piers Plowman," from which we have learned much of what we know about the sadness and misery of the lives of the poor people of that day. It is written in the form of a vision or dream, and deals severely with the sins and evils of the time. Although it was written about the time that Chaucer was writing his poems, a larger number of the words used are strange to our ears, and it is much more difficult to read.

We know nothing, except what the poem tells us, about the author and his life, and indeed it may have been written by more than one person. It is generally believed, however, that at least the most important part was written by a man named William Langland, or Langley, who was born before Chaucer, and died in the same year that Chaucer died. It is thought that he lived at some time of his life in London, but he also knew the country well, else he could not have written as he did of the life of the people. He was probably a priest.

HOW CAXTON SAVED THE STORY OF KING ARTHUR FOR THE WORLD

It is interesting to remember that although books on religion, history and science and law were written in prose, nearly every story that has come down to us from the time of which we have been reading, was written in verse. Perhaps men had not yet gained enough skill in the use of their language to write stories in prose and make them interesting. Perhaps they had not gone far enough away from the time when stories were not written, but were sung by minstrels to the music of their harps, to make an attempt at writing stories in prose.

Chaucer himself wrote some prose. Two of the Canterbury Tales are in prose. He translated a little book called "The Consolations," by Boethius, a Roman philosopher, and he wrote a scientific treatise for his son, whom he lovingly calls "Litel Lowis, my sone," and commends for his ability to learn the science of numbers and proportions, and his love of knowledge. The poet shows himself to us here as a loving father, proud of his little son; but he has not left us a model for prose writing. Latin was then the language universally used by scholars, who corresponded with one another in it, and wrote learned books in it, because it was understood by every man who went to college, or was taught in the monastery schools. English prose writing was left to less learned men, and though, in the course of a century and a half after Chaucer's time, it became beautifully clear and simple, the progress at first was very slow.

It is not until about seventy years after Chaucer's death that what may be called the first real book in English prose was written. This is the "Morte d'Arthur," which was written by Sir Thomas Malory.

It might not have come down to us if William Caxton had not been so moved by its charm that he saved it for us by printing it on the press which, as we read on page 776, he set up under the shadow of Westminster Abbey.

AN UNKNOWN MAN WHO WROTE A VERY FAMOUS BOOK

We know nothing about Sir Thomas except what he has told us himself, that his book was ended in the ninth year of the reign of King Edward IV of England. "Morte d'Arthur" has come to us only through Caxton's printing. The manuscript copies are lost. In it Malory tells, in clear, simple, romantic, and enchanting English, all the legends that cluster round the memory of the British King Arthur, and it remains to this day one of the loveliest books of all the literatures of the world, a storehouse in which the poets, from Milton to the present, have sought for themes.

As the years passed, the Bible, with its nobility of thought, its unrivaled variety of style—narrative, history, drama, impassioned oratory, purest poetry, and simplest talk—became the text-book of the people.

WILLIAM TYNDALE, WHO TRANSLATED THE BIBLE INTO ENGLISH

For many years, people were satisfied with the translation of the Bible which had been made in Wycliffe's time. But as time went on, it was seen that the translation was not good, and a priest named William Tyndale commenced to translate it anew. William Tyndale was born about 1492, nearly a hundred years after Chaucer's death. Like Wycliffe, he went to Oxford University, where he took his degree, and afterward went to Cambridge University, where apparently he studied for some years.

He commenced his translation about the year 1523, but after he had been at work for some time, he found that he would not be allowed to publish it in England. He, therefore, went to Germany, and lived for a time at Cologne. Then he went to Worms, and when he was threatened with arrest at Worms, he went to Antwerp. He worked hard for years at his translation, and part of it had been printed, but in 1535 he was arrested on a charge of heresy, and the next year, he was put to death. He had not finished the work that he had set himself to do, but he had done a great work. The translation he had begun so well was finished by Miles Coverdale, and was used as the foundation of the great translation made in the reign of James I., which we still use and love.

Another writer whom we must mention here is Sir Thomas More, the author of "Utopia," a book on the government of men, and how they should live together. It is a thoughtful work, and some of the ideas which the writer expressed have in our own time been actually made to work. It is the story of an imaginary island republic, in which every one worked, all the people were happy, and the time not spent in labor was used in the improvement of their minds.

Thomas More, the writer of "Utopia," was about fourteen years old when America was discovered. Like his father, he became a lawyer, and was so distinguished in his profession, that he was made a member of the king's council. Henry VIII. showed him great favor, and made him lord chancellor when Wolsey fell from power. But though Henry took delight in his wise counsels, Sir Thomas shrank from friendship with the king, for he knew the dangers to be feared from his fickle-mindedness. His forebodings proved to be true. Because he did not approve of the king's acts, Henry had him arrested for treason, and he was tried and beheaded for an offence which he had not committed. His famous book "Utopia" was written in Latin, and though he wrote many books, we cannot call him a great writer of English.

With the exception of Sir Thomas Malory and Tyndale, and perhaps Miles Coverdale, there are no writers of English, whose names are worthy of being singled out, during the fifteenth and the early part of the sixteenth century. During all this time people were gaining too much new knowledge to do great writing. What is called the New Learning had begun to filter through Europe. The navigators sent out by Portugal and Spain made great discoveries. Everywhere men's minds were waking up to the fact that there were things to learn and beauties in the world of which their fathers had had no idea in the older days.

At first they were almost afraid of the new knowledge, and then their minds were so filled with the wonder of the truths and facts that they had learned that they could scarcely express their thoughts in words. It was not until late Tudor times, when all this learning had become absorbed and been made part of the national life, that the great poets burst forth into the songs that ever since have been the glory of our English tongue.

Meanwhile the language was gaining in strength and dignity. "Utopia" was translated in 1550, by Ralph Robinson. About the same time the beautiful Book of Common Prayer of the English Church was compiled and put into English, and in the religious disputes of the times the great preachers learned to write their sermons or homilies with an earnestness and sincerity that gave nobility to their work.

When Chaucer died, in the year 1400, English poetry had attained a charm unknown in prose. When Queen Mary came to the throne, in 1553, English prose had acquired a grace, sweetness, and strength that it has scarcely surpassed since, while in poetry a stately edifice has been built on the plain foundations that Geoffrey Chaucer laid.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 4029.

ALONG A COUNTRY ROAD

CONTINUED FROM 3896

YEARS ago, when the writer was a boy, he read a story which told of a long walk which two boys had taken. When they were questioned about it, one could remember nothing interesting. The other, who had gone over nearly the same ground, was full of the wonderful things he had seen. One boy had been trained, or had trained himself, to observe, while the other passed through the world without seeing the wonders around him. Which do you suppose got the most pleasure out of life?

Not so many years ago, most of our boys lived in the country, or in the small towns from which they could easily walk into the country. The cities are now growing to be so large that many children seldom see the real country. Parks are sometimes very beautiful, but they are not the country. Many of our boys and girls who own THE BOOK OF KNOWLEDGE live where they can get out into the woods and fields and many others spend their summers in the country. Let us all take a walk and see what we can see.

Some of the things we shall show you cannot be seen on the same day. Some of our pictures were made in the spring and others in the late summer. Then, too, boys and girls are reading this story in places very far apart. Some are in New England, some are in Canada, some in the South and some in the West. English boys and girls read our book, and so do boys and girls in Mexico, Alaska, the Philippines, and the West Indies. Many of you will recognize the pictures we show you. Others cannot see quite the same things, but something very like them.

COWS DIFFER MUCH FROM ONE ANOTHER

Nearly all of you have seen the cows going home from the pasture to be milked, but have you ever noticed how much difference there is in cows? They are quite as different as human beings. There is the cow that minds her own business. As soon as the pasture gate is opened or the bars are let down she starts straight home and does not turn to the right or the left. Another cow tries to turn down every path she crosses, just like a naughty boy, and another suddenly becomes very hungry, and stops to eat, though the grass in the pasture was better than that by the road.

All of our eastern boys and girls have seen roads like those on page 3946. Everywhere in older sections one finds bits of road or village street, where the branches of the trees meet above and make a beautiful arch. Generally the trees are elms, but not all the oaks in New England have been cut down, and you may find buttonwoods, maples and poplars too. When

Copyright, 1918, by M. Perry Mills.

the sun is hot, is it not pleasant to stop and rest in a place like this? While sitting or lying on the grass, you may see dozens of interesting things. Caterpillars are climbing the tree trunks to eat the leaves. Do you remember how the carelessness of one man let loose the gypsy moth, which has done so much harm? Hundreds of fine trees have been killed, because a tree cannot breathe without its leaves. You may watch the busy ants, red and black, as they hurry along. But you must be careful, for poison ivy grows freely by the roadside, and you may suffer if you are not careful. The harmless Virginia creeper is common, too, but if you will remember that the ivy has only three leaves, while the creeper has five, you may save yourself pain.

WHAT YOU MAY SEE IN THE LITTLE POND

The little pond beside the road is full of life. Tiny fish dart here and there and a great dragon fly hovers over the water. Did you see the big green frog before he jumped into the water with a splash? On the trunk of the tree which has fallen into the pond you may often see turtles sunning themselves, or you may find a tortoise crawling along the dusty road. When he sees you, in go his head and tail, and you must wait a long time before he peeps out. Perhaps you may see the brilliant cardinal flower, or the blue flag growing beside the pond or on the banks of a ditch. In marshy places the fringed gentian grows. Do you know Bryant's poem on this flower, which you can find on page 4899?

The roadsides present an ever changing array of flowers, if too many people have not passed along and picked them. The ox-eye daisies you know, the buttercup, the dandelion, and the wild carrot, too. Then you can recognize the asters, purple and white, in the late summer. Do you know the curious Indian pipes, which grow in open woods? There are dozens of others which you can learn to know from other stories in our book. Nothing gives more pleasure than to know the wild flowers of the road and meadow.

Have you ever tasted the delicious blackberries picked from a high spray, where they can get the sun? Do you know that the red ones are "green" and that only the rich purply-black ones are ripe? The British blackberries are seldom so good as those in this country. Have you ever picked and broken open the chestnut burrs which have fallen from the tree, and found the glistening brown nuts packed in their velvet caskets? In the South the boys and girls pick chinquapins, which are small roundish nuts, covered with prickly burrs like the chestnuts. The chinquapin tree is only a shrub. All of you have picked up hickory nuts, I am sure, but the black walnut and the butternut are growing scarce now because the timber of the trees is so valuable.

In the low places beside the road the ferns no longer cling to the ground but stand up straight two or even three feet. One can think what the earth must have looked like thousands of years ago, when ferns grew as tall as trees, and then were buried slowly to change to coal. Do you know the difference between the ferns? There are dozens of different kinds, but none is more lovely than the graceful maidenhair. All New England boys and girls know the sweet fern, which is really not a fern at all, though its leaves are fernlike.

BIRDS AND BEASTS YOU MAY SEE ON A COUNTRY WALK

If you have kept your eyes open you have seen dozens of living things. Perhaps a cardinal or a scarlet tanager has flitted across the road. Sometimes one hears a blue jay scolding or sees him in the trees. A dainty humming-bird hangs suspended before a flower. Late in the summer or very early the fields may be covered with blackbirds going North or South. The friendly robin appears early in the spring. Our English readers see their robin hopping about, but he is quite different from the robin one sees in the United States and Canada. Then there are always quiet birds that move noiselessly through the branches. Perhaps you can find a sparrow's nest with its speckled eggs in the shrubs beside the road. I do not mean the noisy, impudent English sparrow, with his dirty, slovenly nest, but the well-made home of the daintier members of the family. We show you some birds in their natural colors in another place. The quail, or bob-white, you surely know and have heard his call, but have you ever seen the tiny quail only a few days old? Sometimes you may see them if you are quiet. When alarmed they squat where they are and sharp eyes are required to discover them.

When you have seen a wild squirrel in the trees you will think the fat squirrel in the park looks clumsy and awkward. Did a rabbit ever run across the road in front of you? Have you ever seen a little baby rabbit? Sometimes it does not try to run away, but crouches down, thinking it will not be seen. It takes sharp eyes to find it then, but sometimes it will let you pick it up. Perhaps it is paralyzed with fear. Sometimes you may see one of the flesh-eating animals, a weasel, or a mink. One day, while sitting quietly under a tree, the writer saw a mother skunk with four or five baby skunks tiptoe across the road.

THE CLEAN LITTLE PIGS IN THE PASTURE

The pastures are full of interest. Pigs are always amusing, and you may see white pigs, black pigs, red pigs, and spotted pigs. Do you know the different breeds? One who knows can tell you about them. These are Berkshires, one of the best breeds. Little pigs run around rooting with such important airs. Do not try to touch one, though, if the mother pig is close by, for she will fight like a tiger for her babies. A mother horse is usually more sensible. She does not think that any one is likely to harm her colt, and he is likely to be very friendly, and may come up to the fence to be patted. A mother horse will fight for her foal if necessary however.

That horse you see rolling upon the ground is not sick, but is wallowing. Why it does so no one knows, but all horses like to throw themselves upon the ground and roll over. Did you notice how it got up? Horses always get up on their fore legs first, but a cow stands on her hind legs while still resting on the knees of her fore legs.

Perhaps you will come to a farmyard, and it is always interesting. Turkeys strut around as if they owned the place, and the geese waddle about and hiss. Guineas are not very common but they are sometimes seen. This fowl has not really been tamed, but is still half wild. Do you know the different breeds of chickens? In another story we show you some colored pictures of chickens, and the town boy or girl can easily learn some of the more common ones.

Sheep are often seen in these pastures, and may come crowding up to the fence or wall, though they are more likely to pay no attention to you, unless you come too close. Then one starts running and all follow. In the spring, the little lambs play around, but the older ones seem to eat all the time. After shearing, they look lean and ragged, but their coats may be your coat by and by.

EVERY SEASON HAS ITS OWN SIGHTS TO SHOW

Every season has its pleasures in the country. After the winter we are sure that nothing can be more beautiful than the spring, when the tender green of the trees seems to hang like a veil over them. You can see the plough, pulled by two or four horses, turning up the warm brown earth, and burying the sod. You have all seen the ordinary plough, cutting through the earth like a boat through water; but you may not have seen the plough like the one we show. It is a disc plough and does good work.

Summer brings its own sights too. The leaves of the trees are full-grown, and flowers are everywhere, though the flowers of spring have gone, and there is a delicious rich smell in the air. Do you hear the clack of the mowing machine on the other side of the field? Notice how the grass falls before the blade. There is no odor more delicious than that of new mown hay. The next day, perhaps, if the weather is fine, men may be loading the hay into the wagon. Have you ever ridden on the top of the springy load?

Autumn, or late summer, is interesting also. There are not so many flowers, but the bright fruits and seeds almost take their place. The leaves are changing to scarlet| and gold. Do you know whether that tree which stands out so clearly like a flaming torch is a maple or a liquidambar, better known as a sweet-gum?

Many of our readers have never seen the country in winter, but it is interesting, too, though none of our pictures here show it to you.

These are only a few of the things some one or other of our boys and girls may see on a walk along a country road. If you learn to use your eyes, you will always have a good time in the country. Beast and bird, insect and flower are all there in many forms if you will only look, and look quietly. On one hillside, a lady the writer knows found over three hundred different wild flowers.

THE NEXT NATURE STORY IS ON PAGE 4013.

THE SIMPLE BEAUTY OF A QUIET LANE

The poet tells us that "God made the country and man made the town," and though we may see the roadman at work in a country lane, the beauty and calm make us feel the truth of the poet's sentiment.

Some country roads have a beauty all their own. Flanked by magnificent trees, nodding beeches, graceful elms, massive oaks, and tall, waving poplars, they present a scene like a picture from paradise.

A PARADISE OF LIFE AND COLOR

A little pond beside a lane may not have the unceasing motion of the torrent, or the dancing movement of the brook, but let a stone be dropped on its placid surface and the water is instinct with the spirit of life.

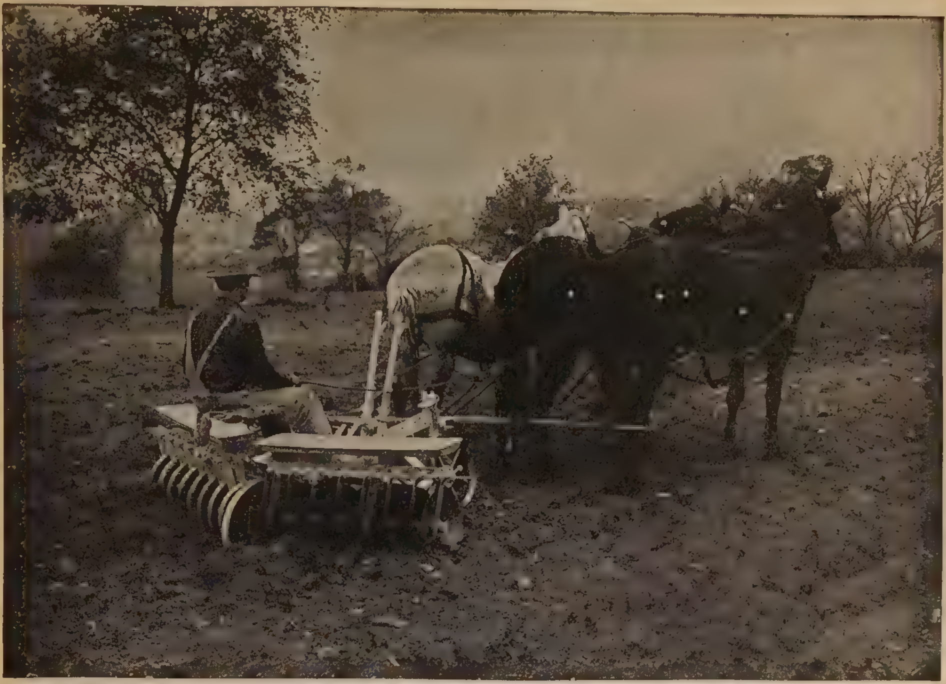
From spring to autumn the roadsides and hedgerows of New England, "sunny spots of greenery," are lined with mingled blossoms, where, as a poet has written, "the raptured eye hurries from joy to joy."

SHADY NOOKS BY THE SIDE OF THE LANE

Every here and there, by the side of the road, we find a delightful spot like this, where we may gather nuts in the autumn. There is a peculiar pleasure in reaching after the nuts that are so near and yet so far.

A ferny nook like this tempts us to turn aside from our walk in the country road, and to roam in the shade, wandering among the bracken that grows so picturesquely beneath the trees. It is always cool among ferns.

GLIMPSES OF LIFE IN THE COUNTRYSIDE



This is a curious plough, or harrow, which you see sometimes in the country. It is used on land which has already been ploughed in order to cut up the clods and lumps more thoroughly, so that the air can get into the soil. The plants grow better when the soil is light and fine around their roots.

When the "ploughman homeward plods his weary way," it is usually with his horses, and the scene in this picture is a familiar one in the country when ploughing has begun in earnest.

The photographs on these pages are by Percy Collins, W. Reid, R. W. Copeman and Brown Bros.

PEEPS OF THE FIELDS FROM THE LANE

Not only in the lane is there much to interest and delight us, but as we look over the fence, or through the hedge, we see sights like this. Pigs in clover are always happy, although they cannot be called pretty.

Perhaps we may see a horse with its foal. And, surely, of all the pretty sights to be seen in the country, none is quainter than this! The foal seems so very funny with its long legs out of all proportion to its body.

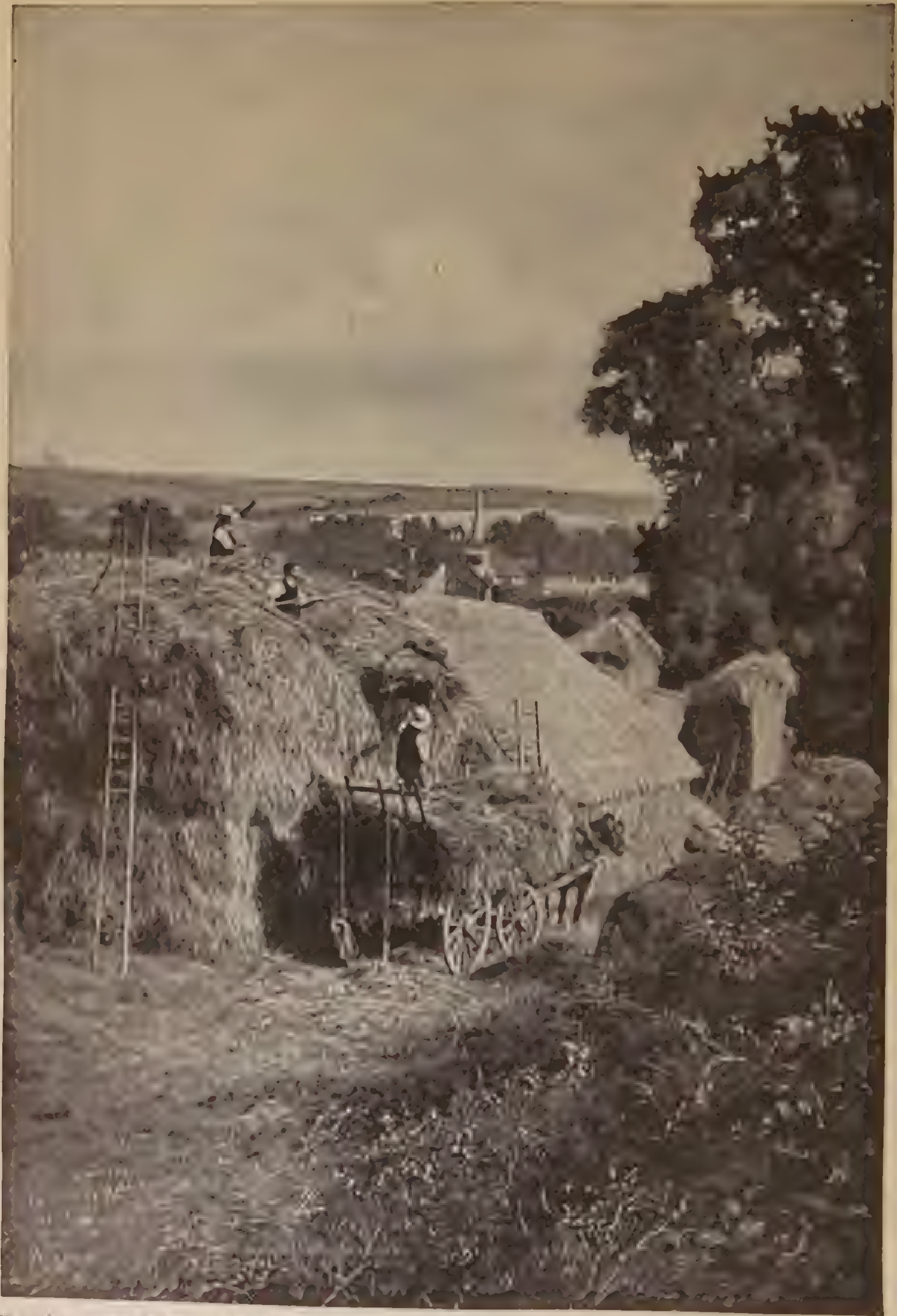
CUTTING AND LOADING THE HAY

The haymaker with a scythe is more picturesque, but the mower does much more work. You can see the blade as it stretches out into the edge of the grass. When the horses start, the grass falls steadily before the moving blade. The odor of new-mown hay is one of the most delicious scents of the fragrant summer, which has so many delightful surprises for the city boy or girl who can go to the country then.

After the hay has dried, it is raked up and loaded upon wagons to go to the barn, or to the stacks, to be kept until wanted. If you have learned to know the farmer, he may allow you to ride to the barn upon the load. It is as springy as the best chair you ever sat in, and the sensation of motion is delightful.

Pictures in this page and the top picture on page 3949 by Brown Bros.

PUTTING THE LAST LOAD ON THE STACK



There is no more delightful sight in all the countryside than a scene such as this, where the last load of hay is being put upon the stack, and the harvest is about to be completed. Such typical farming scenes are, however, fast disappearing, for even the unloading of the wagon and building of the stack are now done by machinery.

WHEEL FOR CATCHING SALMON ON THE COLUMBIA RIVER

THE OCEAN WEALTH OF CANADA

CANADA is fifth among the countries of the world in the value of fish caught and sold. That does not give her a very high rank, but you must remember that the population of the Dominion is small, and so to Canadians the industry is much more important than it is to the people of most other countries. The value of the fish—including lobsters and oysters—caught by Canadians is around $60,000,000 a year. Nova Scotia and British Columbia have the most valuable fisheries.

DOUBLE CONTROL OVER THE FISHERIES

In Canada, the Dominion Government and the provincial governments share the control over the fisheries, and this has caused a great deal of trouble; for, until quite recently, a fisherman could not be sure to whom to go for permission to do what he wished. This difficulty has now been settled, or is being settled, but, in the meantime, a great deal of harm has been done and the fisheries have suffered very much. This is one reason, among others, why the value of the fishing catch has not increased as it should.

Most of what you have been told about fishing in Newfoundland is true about the cod and herring fisheries along the Atlantic coast of Canada, so that what I shall tell you here is in addition to what you have already read, or may read, in the article on Newfoundland. Cod and herring are both caught on the Pacific coast. The Pacific coast cod fishery is not important, but the herring fishery of this coast is of growing value. The Pacific coast cod is the same as the cod of the Atlantic, and it is supposed that the fish come down through the Arctic. The herring of the Pacific is not quite the same as the herring of the Atlantic, but it is very closely related.

SALMON IN BRITISH COLUMBIA

The most important of all Canadian fish is the British Columbia salmon, because the value of the salmon caught there is even greater than the value of the cod caught on the Atlantic coast by Canadians. This salmon is not a true salmon at all for, unlike the salmon of eastern America and other countries, it dies shortly after spawning. In spite of this, I shall call it a salmon, as that is the name it commonly bears.

Vast schools of these fish come in from the sea and swim up the rivers to their spawning grounds, and it is at this time that they are caught in great quantities. Nobody knows

Copyright, 1913, 1918, by M. Perry Mills.

much about the way in which they live or the food which they eat while they are in the ocean, as they seem to prefer the deep water, where it is not easy to study their method of life. But when the call sounds, they start for the shore in myriads and ascend the rivers, jostling one another on the way, dashing up the rapids, leaping the falls, all in mad haste to reach the spawning grounds. We may read more about these interesting fish in the story of Fish of the Rivers and Lakes.

THE DIFFERENT KINDS OF SALMON IN BRITISH COLUMBIA

The kind which is most used for canning is called the Sock-eye. It is rather small, for a salmon, and weighs from three to ten pounds. Its flesh is of a deep red color, and that is the principal reason why it is preferred to its brothers. The number of these salmon is greatest every fourth year, and this difference in the "run" is seen best in the Fraser River. Why there should be three lean years, followed by a fat year, no one knows, but such is the case.

The Spring or Quinnat salmon is the largest of all, and weighs from eighteen to thirty pounds. This is the boldest and strongest of them all; but in Canada it is not used so much for canning, because the flesh of many is white and not so pleasing in color as that of the Sock-eye. Often, however, it is quite red.

The Coho is about the same size as the Sock-eye, and is used for canning to a greater extent than was formerly the case. This is the kind of British Columbia salmon which people in the east of North America know best, for it is sent in ice to places which are as far east as Boston. Of course, it is desirable to get it to market as soon as possible, and the cars in which it is carried are sent east either as fast freight or they are attached to passenger trains.

The Dog salmon is called by that name, because the teeth of the males at the spawning season are shaped a little like a dog's teeth. These fish are caught in large numbers by the Japanese living in British Columbia. The fish are salted and dried, and sent to Japan and China for sale.

The last and least important of the different kinds of salmon is the Humpback, which gets its name from the odd hump on its back. It is rather a small fish and weighs from three to six pounds. The "run" is much larger every other year. It is a fish that is not considered very valuable, and the catch is quite small.

WHERE THE HALIBUT AND HADDOCK COME FROM

The halibut fishery comes next in importance to the herring fishery. Large quantities of halibut are still caught in the Atlantic Ocean; but the fish have become fewer in number in the western seas and fishermen have to go much further north, and further out from land to find them. At the same time the value of the halibut fishery on the Pacific coast has increased, and the greater part of the halibut which is sold in the eastern markets of Canada comes from the fisheries off the coast of British Columbia.

As we have learned in another place, halibut is a flat fish. It lives at the bottom of the ocean and loves best the cold water of the deep seas of northern regions.

The haddock, which is a member of the cod family, also adds to the wealth of our Canadian fisheries. It is fished for in the same way as the cod, and indeed large numbers of haddock are caught in the same nets as cod. It does not go so far north as the cod, and no haddock is found in the Pacific Ocean. This fish is usually smoked and dried, and Canadians who live inland know it best as the toothsome "finnan haddie" of our breakfast tables.

SARDINES ARE CAUGHT IN CANADIAN WATERS

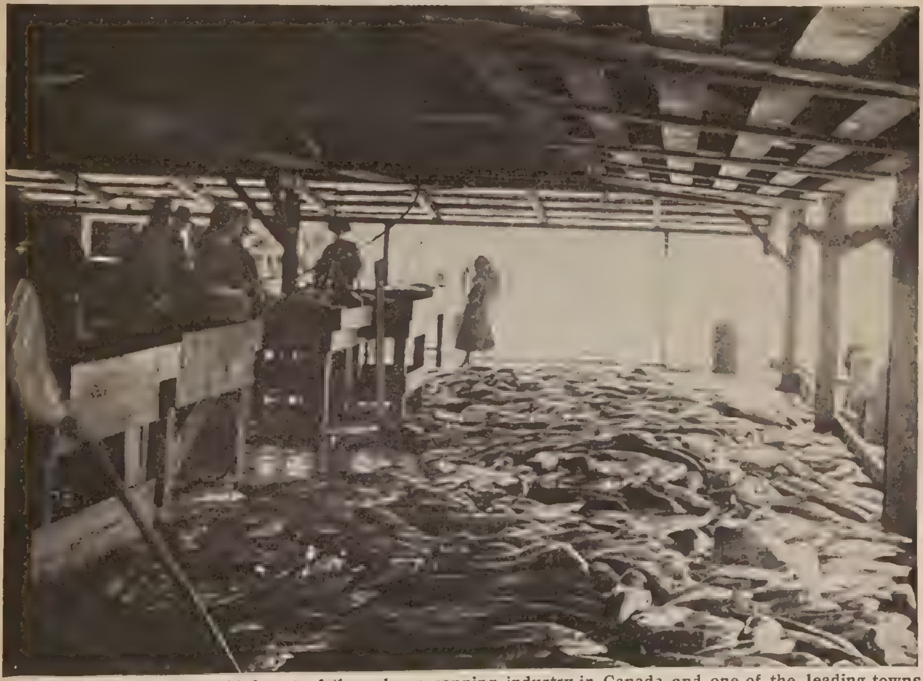
We usually think of sardines as coming from France; but the fact of the matter is that a large number of the sardines which we buy are caught in our own waters. Although they are much smaller than herrings, sardines belong to the herring family, and are caught in nets with small meshes.

After they are caught, they are washed and dried. They are then soaked in boiling oil and packed into boxes so tightly that we use the packing as a proverb, and speak of things or people as "being packed like sardines" in a tin. After they are packed, and every space in the tin is filled with oil, the tin is soldered up, and the fish is then cooked by boiling the tin.

Hundreds of thousands of dollars worth of these little fish are caught by Canadian fishermen every year and cured.

SALMON BY THE HUNDRED THOUSAND

If you are inclined to doubt whether the posters on all the cars of this long train saying that they are loaded with canned salmon tell the truth, look at the picture below, and remember that it shows only a part of one cannery and that there are many others along the river, some only a few yards away. This picture was made at the railway station at New Westminster, a thriving town in British Columbia.



The Fraser River is the chief seat of the salmon canning industry in Canada and one of the leading towns in New Westminster. Here we see the salmon thrown upon the landing stage. The men and women, indistinct figures to the left, will clean them, and soon they will be encased in tin ready to start on a journey which may be across the continent or even to the other side of the world.

WHITEFISH FROM THE LAKES AND RIVERS

I imagine that most of you know something about whitefish, since they are so much liked for their delicate flavor. One of the early French explorers in Canada remarked that they were the only kind of fish of which one did not soon tire, for as a rule a continual fish diet is far from pleasing. The most of these fish in Canada are taken from the Great Lakes, although the lakes and rivers of the West are yielding a larger and larger supply every year. They are caught in numbers in Lake Winnipeg.

As a rule, they prefer shallow water, so that they are caught along the shores of the lakes. Nor do they stray very far from the place where they are accustomed to feed. The one exception is in Lake Erie, the shallowest of all the Great Lakes, where they are found even in the centre of the lake. Our duty is to enforce more strictly the laws for their preservation, and thus give the fish a chance in the unequal fight for their existence.

LOBSTERS AND TRAPS TO CATCH THEM

Lobsters are found along the Atlantic coast of the Dominion. They are caught in traps in which bait has been placed, and the traps themselves are anchored in rather shallow water near the shore. The traps are made of slats, through which the water flows freely. The entrance is through a funnel-shaped passage, with the large end facing outward. This makes it easy for the lobster to find its way in, but difficult for it to get out.

The lobster itself is a very hardy creature, which will live for a long time out of water if well packed in ice. It is in this way that a good many are taken to market. Most of them, however, are canned in some of the numerous factories along the Atlantic coast. As you probably know, the lobster is green in color when alive, but when covered with boiling water, the shell takes on the bright red color with which you are familiar.

DECREASE IN THE NUMBER OF LOBSTERS

The number of lobsters is becoming smaller each year, and many are the plans which have been made to meet the situation. In all cases, there is a close season, during which they may not be caught. Sometimes the space between the slats of the traps is fixed by law, so that the small lobsters may escape, and sometimes the fishermen are not allowed to catch the little ones. It is doubtful whether it is worth while to protect the small lobster, because it is the full grown female which lays the most eggs, and the bigger she is the more eggs she lays. I am sorry to add that the fishermen and lobster canners do not obey the laws very well, and so matters are in rather a bad way. Nevertheless the lobster fishery brings in some millions of dollars every year, and ranks, in value, just after the herring.

OYSTERS FROM PRINCE EDWARD ISLAND

Canadians like to think that the best oysters in the world come from Malpeque, in Prince Edward Island. This may or may not be true, but the oysters which are found there are certainly very fine. They used to be so numerous that the farmers used them to fertilize their land. As a result of this and other things, they have become quite scarce in all the Maritime Provinces. They are found also on the Pacific coast, but the oysters there belong to a different family from those in the Maritime Provinces, and they are not nearly so large nor of such good flavor as their Atlantic cousins. Some of the Atlantic kind have been taken to British Columbia, and placed in the Pacific, but we do not know yet whether the experiment is a success.

THE INTERESTING STORY OF THE OYSTER

The life history of the oyster is very interesting. The egg itself, in the course of four or five hours, turns into the larva, as it is called. Both of these are so small that you cannot see them without a microscope, the egg being only 1-500 of an inch across. The larva swims about for a month or so, and then attaches itself to a stone or piece of shell, or any smooth surface which it may find in the water. In this state it is called a spat, and it does not become a full-grown oyster for four or five years. The only time that it can swim is during the month that it is in the larva stage, although an oyster is able to move about a little on the bottom of the ocean.

HOW OYSTERS ARE GATHERED FOR MARKET

Oysters are not caught in traps, because they do not move about, but wait for their food to come to them. The oyster fisherman gets his catch by raking the bed of the sea, and the best place to find the victims is near the mouth of a river, or in a bay where the water is partly fresh and partly salt. The fishing is done with things shaped a little like large rakes or scoops, by means of which the oysters are scooped up and placed in the fisherman's boat.

This is a very clumsy way of fishing, but it is hard to see what other method can be used. And it is not only clumsy, but very costly, for thousands and thousands of spat and little oysters are killed in the process, and many full grown oysters are either crushed to death or smothered in mud. Considering the number caught and the much greater number killed in the spat stage, the poor things have a very hard time of it, as you can imagine, and it is no wonder that their numbers have become very much less. You may learn more about the habits of oysters and lobsters in the Story of Sea Animals in Armor in another place in the book.

THE ENORMOUS NUMBER OF FISH EGGS PRODUCED EACH YEAR

When you think of the enormous number of eggs that one fish will lay, you may consider it strange that the fish themselves are growing scarcer each year. The female oyster, for instance, yields about 16,000,000 eggs a year, but very few of these ever become oysters. Man is their worst enemy. Many of the eggs die almost at once, and many of the others, which become larvæ or spat, are eaten by fish or destroyed by fishermen in the way that I showed you.

A lobster eight inches long will lay about 8,000 eggs. As the lobster grows larger, the number of eggs becomes greater. A lobster sixteen inches long will yield about 80,000 eggs, and larger lobsters, still more. But not more than one egg in ten or fifteen thousand ever becomes a full grown lobster, so numerous and destructive are its enemies in the sea. Of course, when the eggs are hatched in protected water and taken care of, the number of lobsters obtained from them is much greater. You will, therefore, see the necessity for hatcheries for all kinds of fish, and you will also see that we must obey the fishing laws, and make others obey them, if we want to preserve our fisheries.

HATCHERIES WHERE FISH EGGS ARE HATCHED AND CARED FOR

One of the best methods of increasing the number of fish is to protect the eggs and young fish from their enemies. The Dominion Government has established a great many hatcheries at different places in Canada for this purpose. Here the eggs of different kinds of fish are placed and hatched, and the little fish protected and fed until they are big enough to take care of themselves.

A hatchery is an interesting sight. One can see the eggs of various sorts of fish, the little fish just hatched, and can follow their growth, until they are ready to be placed in the lakes or streams to shift for themselves. Often the baby fish show little resemblance to the full grown specimens.

In the case of the oysters, the Dominion Government has allowed the Maritime Provinces to rent the oyster beds to people who will have the sole charge of them. This has proved a good plan in Maryland and other places, and ought to be a success in Canada, since anything which belongs to a particular person is likely to be cared for better than a thing belonging to every one, for every one's property is no one's. There is also a group of men in Canada who are interested in this and other questions about fish, and they advise the government what to do. These men are members of a section of the "Commission of Conservation," and they meet every year to talk over ways of protecting the fish.

The story of Captains Courageous, which you may read in another place, gives a good account of the perilous lives of the fishermen and the hardships which these brave men endure without complaint. It is true that it is a story of Gloucester fishermen, but life on a fishing boat is very much the same in all the northern seas, whether they are east or west, or whether they are north or south of the border line. Sailing vessels like the We're Here are gradually being replaced by steamboats and powerboats, which are not dependent on the winds for power to reach their havens. But when all is said, the difficulties to be met by the strong men who go out into the deep to fish are still great, and they face many perils, and meet great adventures in their dangerous calling.

THE NEXT STORY OF CANADA IS IN ANOTHER VOLUME.

FISH OF THE STREAM AND OF THE SEA

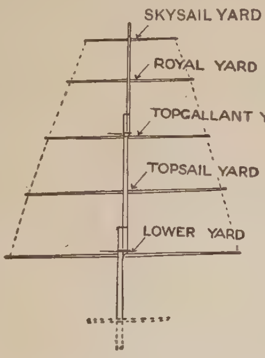
There are also multitudes of fresh water fish in Canadian streams and lakes. While, of course, many are caught for sale, thousands of men spend their vacations fishing in the woods. Successful business and professional men, accustomed to every comfort in their homes, throw themselves into the primitive life of the camp with real enjoyment. This picture is called "A Good Catch" and represents a morning's work.

Though the herring is not so large as some of the fish we have pictured it makes up by numbers for its lack of size. Millions are caught every year in both the Atlantic and the Pacific. Herring in Canada are caught in nets in shallow water along the coast. Boats do not follow them to sea as in Europe. This picture from the Maritime Provinces shows the net supported by poles, and the men drawing it.

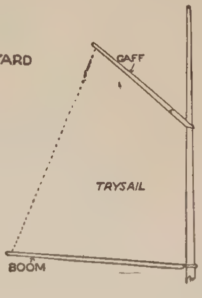
HOW TO KNOW SAILING SHIPS

CONTINUED FROM 3903

TO hear men talk about sailing ships is sometimes very confusing. Many boys and even men who live by the sea, and see ships sail along the coast and come into harbor, do not know the names of the various kinds of ships, and cannot distinguish one kind of ship from another. They may hear sailors and other people talk about a schooner and a brig and yawl, but they cannot tell one of these things if they see one. There may be an excuse for this sort of ignorance if we have never had the opportunity of learning what the different kinds of ships are like, but there will be no excuse for *us* if we do not know them, because this article and the pictures in it have been specially prepared in order that we may learn many things worth knowing about the rig of sailing ships.



1. Yards.

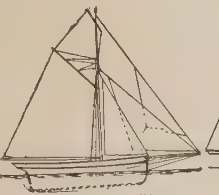


2. Trysail.

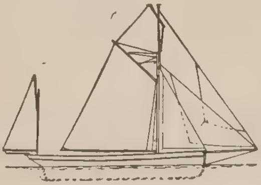
It is necessary to begin by understanding something about masts and sails. A mast is a long pole sticking upright, or nearly upright, in the ship and made to carry a sail, or several sails. The masts stick up through the deck. A mast is always tapered, its lower end is very securely fixed to the bottom part of the ship, and a rope, usually a wire rope—and sometimes more than one rope—has one end attached to the mast near the top, and the other end attached to the sides of the deck or to another mast. If there is only one mast in a ship it is called simply *the mast.* If there are two masts the front one is called the *foremast*, and the second one is the *mainmast.* If there are three masts the third is called the *mizzen-mast*, and if there is a fourth mast it is called the *jigger-mast* if it has no yards, and the *after-mizzen mast* if it has yards. We shall see what yards are presently. Masts for large ships are made in more than one piece, and these are fastened together as you may see in picture 1.

Every sailing ship has a *bowsprit*, that is, a spar sticking out in front in a horizontal, or almost a horizontal, position.

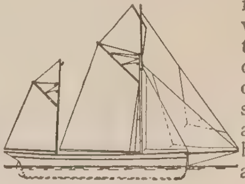
The sails could not spread out on the masts alone; there must be spars attached to the masts to assist in carrying the sails. There are three kinds of such spars, and they are called *yards*, as shown in picture 1, and *booms* and *gaffs*, as shown in picture 2. The yard is a spar that goes across the mast; from it and in front of the mast the sail hangs downwards. In its normal position the length of the yard is across the ship, but, of course, it can be moved around to any angle so as to catch the wind. The boom is a horizontal spar, and it stretches backwards from the mast towards the stern, or back, of the ship. It also can be moved around so as to



3. Cutter, or Sloop.

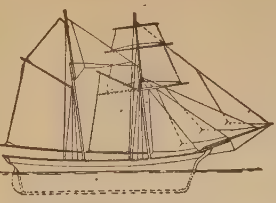


4. Yawl.

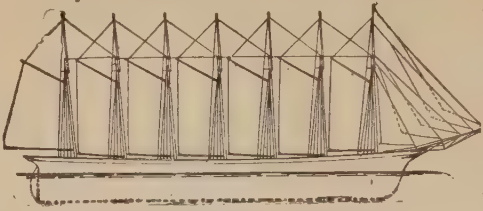


5. English Ketch.

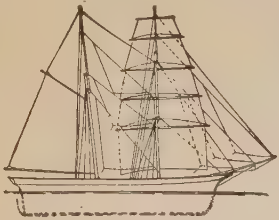
Copyright, 1918, by M. Perry Mills.



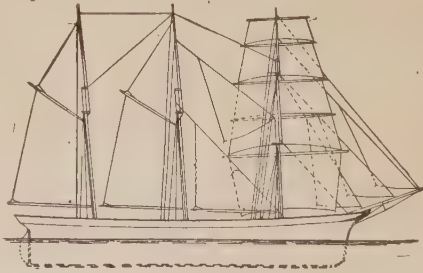
6. English Schooner



8. Fore-and-aft Seven-masted Schooner.

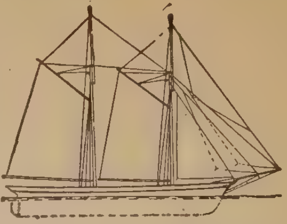


9. Brigantine.

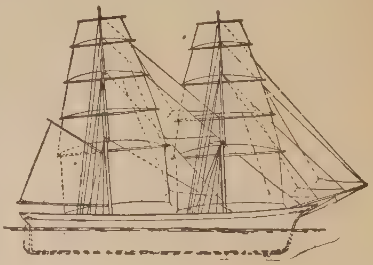


11. Barkentine.

spread the sail to catch the wind from any quarter. The gaff is something like a boom, and it holds at the top the sail which the boom holds below. Its position is not horizontal; it slopes upwards towards its point. The spars on the masts are called by the names of yards. The foreyard is the yard on the foremast, the mainboom is the boom on the mainmast, the mizzen-gaff is the gaff on the mizzen-mast and so on. The sail between a boom and a gaff is called a *trysail*, or a *spanker*, and is illustrated in picture 2. A mast cannot have more than one boom and one gaff, but it may have several yards. The bottom yard, which is well shown in the first picture, is called the *lower yard*, or by the name of its mast, as *foreyard*, *mainyard*, etc. The one above it is the *topsail yard* or if the topsail is in two parts, the two parts are called the *lower topsail yard* and the *upper topsail yard*, respectively. Above the topsail *is the topgallant yard*, or if the topgallant sail is in two parts, the two parts are called the *lower topgallant yard* and the *upper topgallant yard*, respectively. The yard above the topgallant yard is called the *royal yard*, and if there is one higher still, it is known as the *skysail yard*. Now, if we remember these points about masts and sails we are ready to consider the *rigs* of various ships.



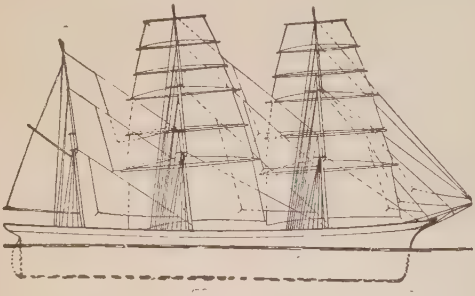
7. Four-and-aft Schooner.



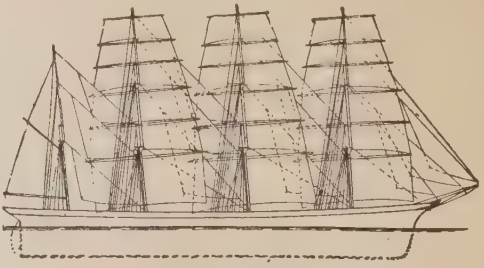
10. Brig.

The name given to the sails and their disposition on the various masts and spars is the *rig*.

Small sailing ships and yachts have what is called the *cutter* rig which is seen in picture 3; there is only one mast, and the *mainsail* is stretched between a boom and a gaff. In the United States this boat is often called a sloop also. Once there was some difference, but now both words are used to describe the same thing. The *yawl* is very like a cutter, but has a small jigger-mast at the stern, as seen in picture 4. The yawl is generally a little larger than a cutter. The *ketch* is like the yawl, but the rear mast is generally larger and further forward. It is seen in picture 5. The rig of the *schooner* is the most common on sailing vessels to-day, especially those which sail up and down the coast. Although steamers may not have sails at all, if they have sails these are the schooner rig. There are two kinds of schooner rig: the ordinary schooner rig, and the fore-and-aft schooner rig. The ordinary schooner rig, which is seen in picture 6, has a foremast with a topsail and topgallantsail, but a trysail instead of a lower yardsail, and on the rear, or main, mast there is a trysail

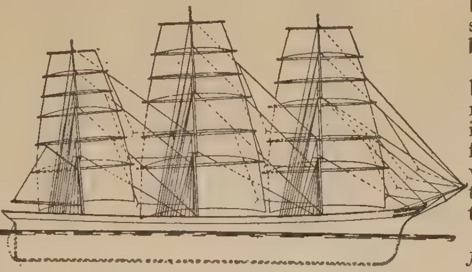


12. Three-masted Bark.



13. Four-masted Bark.

and topsail. The fore-and-aft schooner rig which is most common on this side of the Atlantic, has no yardsails but only trysails, which are generally uniform on all the masts. In picture 7 we see a two-masted schooner with fore-and-aft sails, and in picture 8 is shown a seven-masted schooner with fore-and-aft rig. A schooner may have as many masts as may be found convenient and still be a schooner. Some very large schooners have been built in the United States. If a schooner of the first-mentioned type has more than two masts, the foremast only has yards, the remaining masts having trysails only.



14. A Full-Rigged Ship.

The rig of the *brig* is a rare type in these days. It is found only on two-masted ships, and, as seen in picture 10, it has a main, or rear, mast with yardsails and one trysail, and a foremast with yardsails only.

The *brigantine* and the *barkantine* are much alike. The brigantine has a foremast with yards and a mainmast with a fore-and-aft sail like a schooner. The barkantine is seen sometimes in three-masted sailing ships. It is as seen in picture 11, which shows that it is like the brigantine with a mizzen-mast added to it.

The most popular rig for modern sailing ships is the *bark*. It requires not fewer than three masts. The mast nearest the stern has a trysail, but the other masts have yards and yardsails. Picture 12 shows a three-masted bark, and picture 13 shows a four-masted bark.

For very large ships barks are sometimes made with five masts, in which case the front four are rigged alike with yardsails, and only the fifth mast has a trysail.

Finally, there is a *full-rigged ship*, which must have not fewer than three masts, and has sometimes four masts. Only a few full-rigged ships with five masts have been built. All the masts on the full-rigged ship have yards and yardsails, and the mast nearest the stern has a trysail as well. A full-rigged ship with three masts is illustrated in picture 14. In spite of the fact that steamships are quicker, the sailing vessel has not yet disappeared from the seas.

ICES MADE WITHOUT A FREEZER

IN hot summer weather few things are more cooling and refreshing than ices. They cost but little, and can be quite well made at home. If we all knew how easily a delicious ice could be made without an elaborate freezer, we should more often want to make one. Let us see what we can contrive, even if we have no freezer.

First, we shall want a round can with a lid that shuts down tight. A coffee or syrup can would do. Then we want a large square tin cracker box, or a wooden pail. This is to hold the freezing mixture, with the syrup or coffee can in which we are going to make our ices in the middle of it. Before doing so we must see how and why the ice is formed inside the smaller can.

We know that water freezes below a certain temperature, but if we chop up a little ice and pour on it a little water and sprinkle it with coarse salt, we get a very low degree of cold indeed, because the salt acts on the ice and increases its power to freeze. So any liquid will freeze when buried in the freezing mixture, if left there long enough. It would turn into a block of ice if it were not hindered from doing so. How can we prevent it? The liquid will freeze first around the inside of the can, and to stop that we must stir it and scrape the can just as, but for a different reason, we stir the milk in a saucepan.

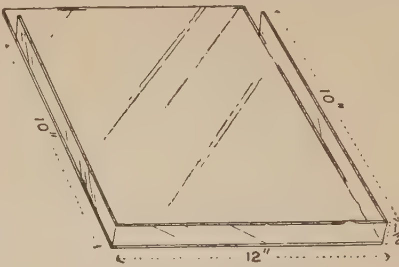
The box or pail has a layer of chopped ice and the salt placed at the bottom; the can is placed on that, and ice and salt are piled around it up to the brim. The ice should be just double the weight of the salt. The mixture for the ice is placed in the can, the lid put on, and a blanket wrapped round the outside of the whole. It is then allowed to stand for some time. Removing the lid, we take our wooden stirrer, and scrape it round and round the inside of the can, to prevent the mixture from freezing solid; and then we replace the lid. We must be careful not to let the salt and ice get into the can, or our ice-cream will be spoiled.

And now what kind of ice shall we make? We can choose a water ice, made with water, or an ice-cream, made with cream. An ice-cream is nicer, but costs more. We may like to make both kinds, or custard can form a substitute for the cream, and fresh fruit or jam can be added.

Water ices can be made by mixing some syrup—sugar boiled in water in the proportion of one pound to one pint—with a fruit-juice from pressed strawberries or raspberries. There should be about twice as much syrup as fruit-juice. An ice-cream without cream is made from a custard in which are a tablespoonful of condensed milk, half a pint of milk, the yolks of two eggs, and sugar. This may be flavored with vanila or essence of almonds, and put into the freezer. Or we can take half a pint of the custard, add to it a quarter of a pound of jam, and if this contains seeds, rub it through a sieve and then freeze it. Coloring paste will make the ice a deeper red.

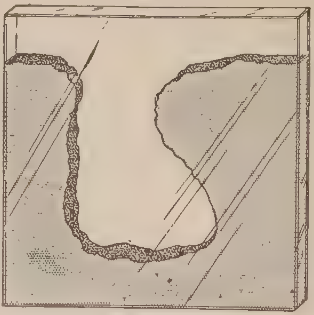
HOW TO KEEP ANTS AS PETS

THE habits of ants are so interesting that men of science have spent a great part of their lives studying them and their habits. We read something about these wonderful little creatures in that part of this book that begins on page 2965, but we may ourselves keep ants as pets in our drawing-room, and very interesting they are. The glass case in which ants are kept in the house is called a *formicarium*, a word that is made up from *formica*, the Latin or scientific name for the ant. Formicariums may be bought all ready and complete at some shops, but it is much more interesting to make our own, and as it is easy to do this, we will first of all see what is needed.



How the glass case is built up.

We must get two sheets of glass, say, twelve inches square, two strips of glass twelve inches long and half an inch wide, and two strips ten inches long and half an inch wide. These may be bought at any glazier's, cut to the sizes named, for a few cents, and ordinary window-glass will do very well. Now we must take one of the squares, and fasten the two ten-inch strips and one of the twelve-inch strips round the sides, flush with the edges, as shown in the first picture. Either glue or paste may be used for this purpose. Then, when the strips are dry, we must stick the other sheet of glass on the top of them, so that we shall have a shallow box without a lid, and with the narrow sides not reaching quite to the top of the wider sides of the case.



The formicarium ready for the ants.

The formicarium is all ready to receive the earth from which the ants are to form their nest or camp. The very best mould for this purpose is, of course, that to be obtained from an ant-hill, and this we can get in almost any garden or field in town or country. The earth may be put into the glass case by pouring it in at the top through a paper funnel, made in the same way that a grocers' sugar-bag is made. Sufficient earth is needed to half fill, or a little more than half fill, the formicarium, and a vacant space should be left in the centre with passages to the openings above the ten-inch strips. The top, which consists of the remaining twelve-inch strip of glass, is then put on the top, and glued or pasted in place. We now have our formicarium all ready for the ants, with two doorways or openings, one on each side, and the appearance of the case is as shown in picture No. 2.

We have next to catch our ants. Any kind will do, and we shall probably find what we want in our garden. We must dig down deep into the encampment to find the queen, who can easily be distinguished by her large size. The pictures on page 2969 of this book will perhaps help us. A bottle is a very good thing in which to carry the ants from the garden to the room where we are making our formicarium. Having put the queen in the bottle, we can place with her about fifty worker ants.

The next task is to get these into the glass case. We must close up one of the little doors with rag or wadding. Then, if we take a tea-tray and fill it with water, and stand a dish in the tray and then lay the formicarium on the dish, the ants' new home will be cut off by water from everywhere. We cover the glass case with a newspaper folded up, and lay our bottle on the paper with the cork out. The ants soon swarm out and all over the paper, but we guide the queen ant towards the opening of the formicarium and get her in, when the worker ants will all follow, and that very soon. As soon as they are in, we should plug up the doorway with a piece of wadding, and our formicarium is complete. We may, of course, ornament it in any way we like, but this is a matter of taste. The ants will soon get to work, and for hours we may watch them making their homes and performing their various duties without any fear of our getting tired, for there is no more absorbing recreation than watching an ant city being built.

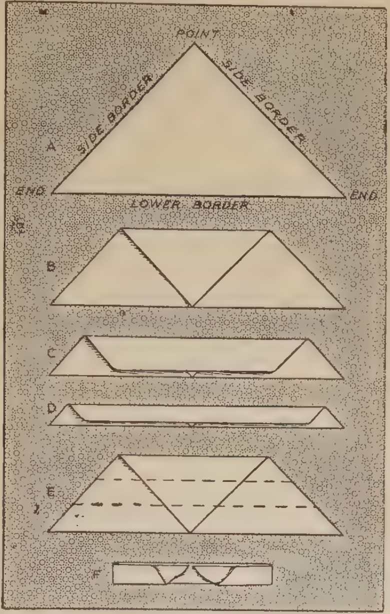
The formicarium should be kept in a shady place, and when not being watched a cloth may be thrown over it. It must never stand in the sun, and it is better to examine the ants by artificial light, as the little creatures do not mind this at all, whereas they do not like daylight, and will soon get out of sight if exposed to it. The earth should be kept moist by squirting a very little water into the case from time to time with a small syringe or a fountain-pen filler. The only food needed by the ants is a little honey placed inside the opening every day or two. A few of the little white creatures that ants make pets of, should be put in the nest, as they act as scavengers, and keep the ant city clean.

Thus completed, we have one of the most wonderful things that can be seen. The ants will make tunnels and corridors and lanes and rooms, and nurseries for their young ones, with front doors and side doors; and all the different kinds of ants will do their different kinds of work right before our eyes. As they have not the chance to get at another nest of ants, they will do no fighting, which is the least nice of all the habits in which the ants are so like men.

GIVING FIRST AID TO THE INJURED

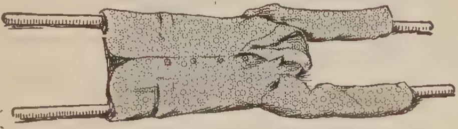
WHAT TO DO UNTIL THE DOCTOR COMES

SOME time ago, in a busy New York street, a man met with a serious accident, and was in danger of bleeding to death. But a boy stepped from the crowd that had gathered round, and making a bandage and pad from a stone and a handkerchief, he tied these on the wounded man in such a way that the bleeding was stopped, and a doctor was able to reach the man in time to save his life.



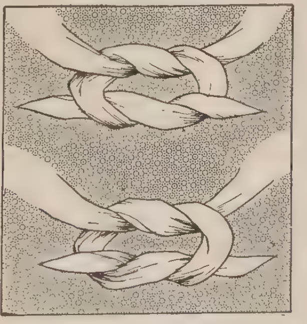
How to fold a triangular bandage.

Now, this was a splendid thing for a boy to do, and it is a thing that every boy and girl who reads this book may do also if necessity arises. The boy who saved the man's life in a New York street had been through a course of study for rendering first aid to the injured; and in these lessons we are going to learn what to do in case of accidents of all kinds—fractures or broken bones hæmorrhage or bleeding, sprains, burns, scalds, bruises, drowning, poisoning, and so on.



A stretcher made from a coat and two poles.

We must distinctly understand that first aid is not intended to take the place of the doctor's work, and in all cases of serious accident we should call a doctor to the patient as soon as possible. But while someone has gone for the medical man, it is important that the very best should be done for the patient. If he has broken his leg, the broken bone must not be allowed to do any further injury; if he has cut himself, the bleeding must be stopped at once; and in all cases the patient must be placed in such a position that he will suffer as little pain as possible. And it is to help every boy and girl to know how to do these things that these lessons on First Aid to the Injured are being given.



Granny knot and reef knot.

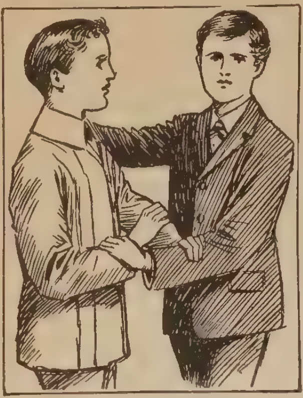
But we must not look upon them as lessons, but as something that will always be useful to us. We shall find a great deal that is very interesting, and when we come to bandaging we can learn to become quite skilful at it by tying up one another for practice. If we are going to be successful and useful in this most valuable study—and surely we all want to be first-rate at everything—there are a number of points that we must remember at the outset.

For instance we must be ever on the alert, so as to be ready to render help immediately an accident occurs; we must be full of resource, so that we can make use of whatever may be at hand, even though proper bandages and splints and stretchers are not available—just as the boy used his handkerchief and a stone from the road for a bandage and pad. Then we must be observant so as to notice all the circumstances of an accident, and in case of several injuries we must decide without any hesitation which of them should have attention first.

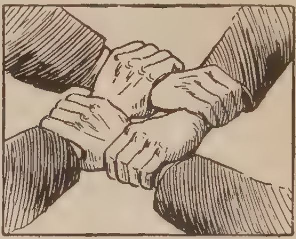
It is important that an injured person should have plenty of air, and if breathing seems to have stopped we must take steps to restore it. Then we must always see that any injured part is carefully supported, and the warmth of the patient should be maintained by placing a cloak or coat round him, especially if the weather is cold.

For broken arms and legs, splints are needed—that is, something solid and firm to which the arm or leg may be bound, so that the parts above and below the fracture may not move independently of one another, and still further increase the injury. For this purpose all kinds of things are useful—walking-sticks, umbrellas, baseball-bats, broom-handles, pieces of wood, and so on; and, before being applied, these should be padded with a coat, or some handkerchiefs, or sacking—anything soft, in fact, in order to prevent any jolting. We shall learn later on how to apply a splint.

We now come to bandages. Bandaging is of the greatest importance in all cases of injury, and when no proper bandages are available we can make them out of handkerchiefs, neckties, belts, and so on. Proper bandages, however, are very often close at hand, as in the case of accidents on the football field, for many players carry a bandage with them, and we must learn how to fold and tie these.


A three-handed seat.

The most useful kind of bandage is the triangular bandage, shown in the picture. Two such bandages are made out of a square yard of calico by cutting diagonally across—that is, from corner to corner. This gives us two triangles of the shape shown in the picture, and each side and angle of the bandage have a special name. From this triangle we can fold a broad or a narrow bandage. We first fold the point to the lower border, as in B, and then for a broad bandage we fold over once again, as at C, and for a narrow bandage still once again, as at D. For a medium bandage we make two folds, as at E, after folding the point to the lower border. When not in use we fold as a narrow bandage and turn the ends in as in F. We shall learn later how this bandage is used for different injuries, but it is necessary for us to know how to tie the bandage when it is on. The granny knot is quite useless because it so easily comes undone. We must always tie a reef knot, shown in the lower picture, so that the bandage may not come undone; a little practice will make this quite easy.


A four-handed seat.

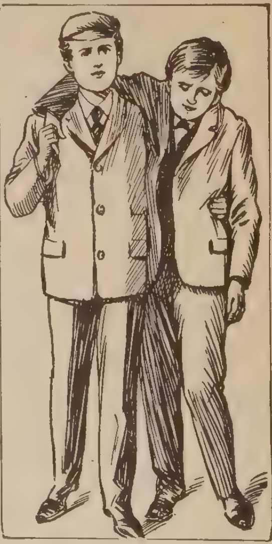
In addition to triangular bandages, there are roller bandages, which are strips of linen, calico, muslin, of different widths and lengths; but for first-aid work the triangular bandage is much simpler to use, and besides, the strips of material would be rarely available in an emergency.

When anyone meets with an accident it is often necessary to remove some of his clothes, such as a coat or boot and stocking. This has to be done very carefully, and there is a regular method to be followed. In removing a coat we take it off the uninjured side first, and then, if necessary, cut the stitches of the seam in the sleeve, and lift the coat away. A shoe should be unbuttoned or unlaced, and the back seam cut open carefully. Stockings or socks can be cut off an injured foot with scissors or penknife. In burns and scalds the clothing must never be dragged from the injury, but any part adhering should be cut round and left for a doctor to attend to.

In lifting and carrying an injured person the greatest care must be exercised, and in serious cases, such as those of injuries to the back, it is better to wait for a doctor's arrival. In other cases, where bones have been broken, the utmost care is needed to prevent the ends of the fractured bone from causing still further injury.

For stretchers we can use hurdles, shutters, or planks, but if we use shutters or planks we must be sure to carry them slung in ropes or straps, in order to save jarring the injured person, and we should place coats upon them to make them soft and comfortable. When nothing of this kind is available, we can make a stretcher by buttoning up a coat and slipping poles through the sleeves and along the sides of the coat as shown in the picture. If a larger stretcher is wanted, two coats may be arranged in this way on the same two poles. Sacks may also be stretched on poles by passing the poles through holes in the bottom corners. Of course, every stretcher should be tested before using.

In lifting a patient on to a stretcher there must be gentle, steady effort without any jarring, and if an arm or leg is injured some helpers must support the wounded limb. The head should also be supported. The stretcher should be carried quite horizontally, and the bearers should, as far as possible, be of the same height. They should march with a short step, and bend the knees as they march. Where no stretcher is available we must make a seat for the patient with our arms. For what is known as a two-handed seat two bearers face each other and stoop down, one on each side of the patient. They each place one arm under his back just below his shoulders, and the other arms are passed under his legs, the hands being clasped. The way to make a three-handed seat, with a rest for the patient's back, and also a four-handed seat, with which another helper must support the patient's back and head, is shown in the pictures. If there is only one helper for an injured man, and the injury is not very great, he may be assisted as shown in the last picture.


Helping an injured man.

If we remember these instructions accurately, we may be of assistance in some emergency.

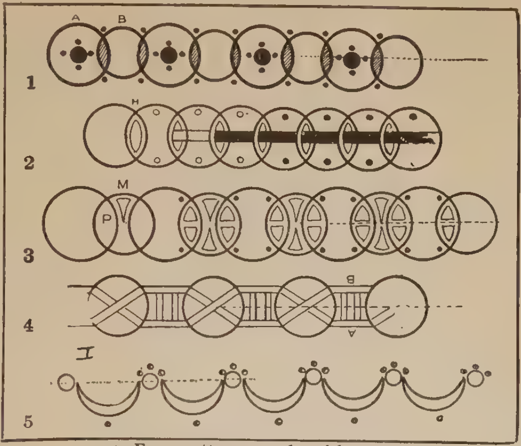
SIMPLE WAYS OF MAKING DESIGNS

WHETHER we are girls and are fond of needlework, embroidery, or china painting, or whether we are boys and do wood-carving, modeling, painting with stain on wood, or stenciling, we shall find the constant need of a pattern. Here we shall see how simple it is to make our own designs, which are very much more interesting to work upon than any we can buy.

We are only going to use ordinary, everyday things to help us to make our patterns—three coins to make circles, a quarter, nickel, and a ten-cent piece, also a rule and a piece of lead pencil.

First let us look at picture 1. This pattern is made with a ten-cent piece and a nickel.

To begin with, we must be sure that our pencil has a sharp, long point.



1-5. Easy patterns made with coins.

We first rule a straight line very faintly. This line is to be a guide only, and not part of the pattern. It is shown as a dotted line in the pictures. Now we take a nickel and place it on the paper over the guiding line, a ten-cent piece on each side, of the line. We should hold it with one finger firmly in position, and with the pencil mark round the edge; remove the coin and we shall find an even circle. In the picture this circle is marked A.

The next circle, B, is made with a ten-cent piece, and it overlaps A by one-eighth of an inch. This distance must be marked off on the guiding line with a ruler, before putting the ten-cent piece in position. To do this we must make a little dot on the guiding line one-eighth of an inch away from the edge of the circle—where it crosses the line—and, of course, it must be *inside* the circle.

This dot shows us how far to *overlap* the ten-cent piece when we place it on the line. We must do this each time we have drawn a circle, using the same distance—that is, one-eighth of an inch exactly.

A design for a sideboard cloth.

We continue to use these two coins alternately until we have made as long a line of circles as we want. The rest is very simple, because anyone can make dots. We must make fairly big ones outside the circles where they cross, and very big ones in the centres of the big circles. The guiding line helps us to see where the big dots are to be placed, and also to place the two dots on either side. We can guess the other two dots—they come top and bottom—and make up our dots round the big dots. If we color in the little shapes formed by the circles overlapping, the design is complete.

Now let us look at picture 3. For this pattern we take a quarter and a nickel, and use them in just the same way as in pattern 1, but with this difference—that the overlap is much bigger. In each case it is three-eighths of an inch, marked P in the picture.

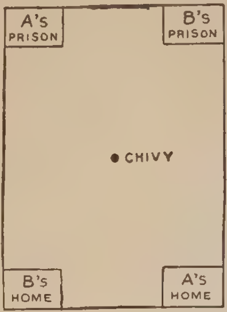
The next thing to put in is really easier than it looks, because it is done "freehand." We must carefully follow the outline of the space marked M, making it a little smaller, with the point of this little shape just touching the guide-line. The other shapes in the picture are filled in in the same way. Then the dots are added—but we must be careful not to make them too small.

Picture 2 shows our next pattern, which is made with a nickel only, and the overlap distance is a quarter of an inch. The spaces formed by the overlap are filled with smaller spaces, outlined in pencil, just as the last pattern was done; then a line is ruled along *each side* of the guide-line, a very short distance away, and made to look as though it threaded itself in and out of the circles by rubbing out with india-rubber the part supposed to be behind. The dots are put in last. Pictures 4 and 5 show two more patterns, both being made with a nickel, much in the same way as the previous ones. For number 4 we must make the circles three-eighths of an inch *apart*, measuring the distance as usual along the guiding line, then drawing the two lines A and B level with each side of the guiding line, and a quarter of an inch away from it. Next we add the connecting bars, two between each circle, and finally join up the outside lines *across* the circles, drawing them so that one seems to go underneath the other.

The half-moon in picture 5 is made by marking only *half*-way round the nickel and then shifting it up a little—about one-eighth of an inch—and marking another half-circle, joining the first one at the points of the moon.

OUTDOOR GAMES FOR BOYS

PRISONERS' BASE



THE playground, or part of it, should have four spaces marked off—one in each corner, as seen in the picture. The distance between the prisoners and homes should be not less than twenty yards. The players divide themselves into two parties, A and B, each party selecting a captain. They then go to their separate homes, and one of the captains sends out "a man" to the place marked in the centre, where he calls the words, "Chivy, chivy!" Out darts one of the enemy to capture him before he can reach home again. But this pursuer has hardly started when one of "Chivy's" friends rushes out to catch the pursuer. Thus one after another all the players leave home, but no one must on any account try to touch any boy except the one he left home to follow. Above all, each should not forget that while he is seeking to capture the enemy, another of the enemy is seeking to catch *him*. This makes matters exciting. A prisoner is made by simply touching a boy; and once this is done the toucher is safe until he has taken his captive to gaol. He may then walk "home" and wait to be ordered out again by his captain. Prisoners are released by one of their own side touching them as he runs by the prison; and if there are many inside, they may join hands and stretch out to meet their friends, so long as the last in the line keeps one foot in gaol. The side that succeeds in making all the others prisoners wins the game, but it has to be a very clever captain who can direct his men so as to manage to do this.

FLY THE GARTER

TO start with, all the players make a running jump, and the one whose jump is shortest has to "give a back" for the others. A chalk line, called the garter, is drawn, and standing close beside this he bends his back and tucks in his head. When the others have gone over him as in leap-frog, he is told to "foot it"—that is, move away from the line the length of his own foot, and bend down again. This time, in going over, each player must start his jump from the "garter," and if all succeed in doing this, the "back" moves on another foot for the next turn. By and by the distance from the garter becomes too great for one of the jumpers; and the first to make a false leap must take the place of the "back," who then joins the others.

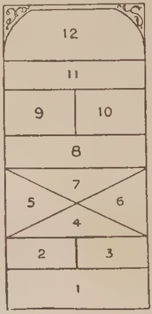
FOX IN THE HOLE

THE "fox" stands on a piece of ground marked off for him to live in. He is allowed to carry a knotted handkerchief for self-defence. When the hunters come to attack, he hops out to meet them on one foot. During the battle that follows he must not put his second foot to the ground, or, if he does, he will be básted home again without the right to hit back. If, however, he touches one of the enemy with his knot while hopping, the one so touched is basted by the rest into his home and becomes fox in his stead. While in his home the fox is quite safe from attack.

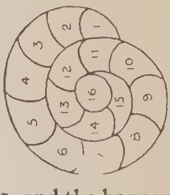
PEE KU

HALF the number of players join hands in a circle, forming what is called a fortress, which the other half seek to take by forcing their way into the middle. The defenders must not loose each other's hands, but may raise them or lower them to stop the attackers getting over or under. They may spread themselves out or draw together in a closer circle when danger is near, and they may change their positions to stop anyone crawling between their legs. If an enemy gets through, he may assist his friends who are trying to follow him, and when half the number are within the fortress, it must "haul down its flag and surrender" to the victorious party.

HOP SCOTCH

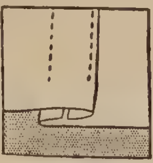


THE game of hop-scotch is played in different ways, but the way which we shall see here is the usual one. We first draw on the pavement of the playground with chalk a plan like this. The larger divisions are about two feet wide. The first player then stands at a short distance and pitches a flat stone or piece of shell into No. 1. If it settles properly in the space, he hops after it and kicks it out again without putting his other foot to the ground. Returning to the starting place, the shell is again tossed, this time into No. 2, and the player hopping after, kicks it out once more, but through No. 1. This action is repeated through every division up to 12, unless the shell settles on a line or is pitched into the wrong division. In either event the player stops and the next player takes his turn. Though only hopping is allowed, any player who gets as far as division 8 may rest by putting one foot in No. 5 and one in number 6, but must go on hopping when he turns to kick the shell out again. On each return journey he may hop and kick as often as he likes, except when the shell has been tossed in No. 12—or the cat's head, as it is sometimes called. *That* time he must kick it out at one kick right through all the divisions. But if he does so, he has won a game, and his hopping labors are over. In French hop the plan on the pavement is drawn like this. The shell is placed in No. 1, and the hoppers kick it through each division till No. 16 is reached. After a short rest it is kicked back the reverse way to No. 1 and out.



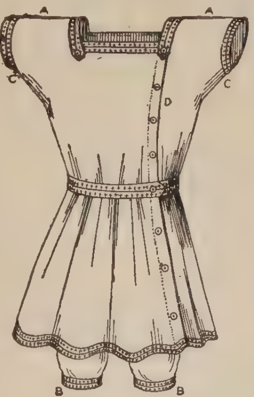
A BATHING-SUIT A GIRL CAN MAKE

A COSTUME suitable for sea-bathing for a girl who does not swim needs to be of a different pattern from one to be worn by a swimmer, when there should be no short skirt to cling round the legs and hamper the movements when swimming; but, on the other hand, a tightly clinging combination suit does not look well for sea-bathing, unless, perhaps, for very little girls. Many people bathe from their own tents and bathing-houses, and have a stretch of sand to run over before reaching the water, so that some kind of tunic skirt is necessary.


1. Seaming.

In the costume shown in picture 2, both these purposes are served. The upper part and the bloomers are *cut in one piece*, and the little tunic skirt is cut separately, and fastened on by buttons and buttonholes. For the material, we should choose a double-width one of serge or Oxford shirting, both wash well and are durable. The shirting has the advantage of being not only washable, but strong and soft; it may be had in a plain blue or striped pattern. Serge in several colors is suitable, and looks well trimmed with a fancy braid. We will make our costume of dark blue serge, and trim it with a white fancy braid. Enough braid will be required to edge the skirt, bloomers, sleeves and neck, as well as to form a belt.

The quantity of the serge depends, of course, on the size of the figure, and a near estimate of it can be made from the shape of the under-garment a girl usually wears, allowing for a very loose fit. Indeed, this may be taken as a correct guide for making the costume. The material is folded lengthways—so that the selvedges run down the length of the garment—the fold coming where the shoulders are, marked A A in the picture. A square neck is then cut out of the centre of the fold; if a high neck is preferred, it can easily be sloped in a curve in front and back.



2. The costume complete.

To form the short sleeves, the material is cut the required length and curved in under the hollow of the arms, and thence to the waist-line, brought out again slightly below it, and taken in again down to the knees. The bloomers part, which is not shown in the picture, does not fasten anywhere, there being plenty of room to slip in and out of the suit through the opening—marked D—at the left side of the front, which is slit down to the waist-line.

To finish off this opening, a false hem is put on to the right side of the slit and double-stitched across at the bottom to make it firm. Through this broad hem five buttonholes are worked. The way to put on a false hem is explained on page 848. A narrow hem is made along the edge to the left of the opening, and white bone buttons are sewn along the right side of it. The hem is made firm to hold the buttons by laying a strip of black tape along the back, and hemming it on in such a way that the stitches do not show on the right side.

And now for the joining up of the sides. From the sleeves to the knees, from C to B, the garment is seamed, and also where the bloomers are cut up to form the legs. Seaming is done by a sewing-machine in this way. Turnings are made at the two edges of the material; these are placed together, as shown in picture 1, and machine-stitched near to the turned edges along both sides. If it is inconvenient to machine-stitch the seams, they can be run and felled. The seam inside the two halves of the bloomers is worked in the same way. The extra fulness at the waist is held in by the band shown in the picture.

The neck is edged back and front with straps of double braid, and two other straps, pointed at the ends, pass over the shoulders and are sewn down with buttons over the ends of the other two. Braid is put round the short sleeves and the bottom of the bloomers.

A double row of braid forms the waistband, which can be strengthened by a piece of the serge at the back, and is then stitched along *its upper edge* for an inch or two to the middle of the waist-line at the back to hold it in position. The waistband is fastened by a button and buttonhole, as seen in the drawing. The skirt is very simply made, for it is cut in a strip, sufficiently long to make the fulness suitable for the figure, and gathered into a narrow waistband of the serge, in which a few buttonholes are made. Hems, one broad and one narrow, are made at the ends. Three buttonholes are worked in the broad one, and corresponding buttons are sewn on to the narrow one to continue the line at D. Buttons to correspond should be sewn on to the under-garment, just under the waistband, so that they are hidden when the skirt is not worn. Braid is sewn round the bottom of it in two rows.

It should be remembered that some kinds of material shrink more than others, and that sea-water is disastrous to certain colors. It would not do to make the costume and then find it shrink; therefore, ample room should be left for movements of the body, especially when stretching full length, as one must do when swimming.

If the girl who is making this bathing-suit understands anything about dressmaking, she will know that if the material at the shoulder-line, marked A in picture 2, is slit, and sloped slightly down towards the arms, the gown will look more shapely than if it were left quite straight. One hardly expects a bathing-suit to fit well like a dress, of course, but, if we do not mind a little extra work, we shall find the little seams suggested a very great improvement indeed.

A LITTLE VEGETABLE GARDEN

WHAT TO DO IN THE MIDDLE OF AUGUST

ANOTHER seed-sowing season has come round again; indeed, as we have seen, there are few months from early spring to late autumn when we may not sow one thing or another. In August the most important crop to think about is the onion. The onions that were sown in the spring, and have been growing all through the summer, are by this time almost ready to lift and dry—much depends, of course, on the district and the date at which they were sown—for winter use. We can even use them for some time in the spring. Then the time comes when, of their own accord, they begin to sprout, and sometimes even to produce fresh roots; then, of course, they are of no more use for cooking. The seeds that we sow in the month of August are intended to produce a crop to follow these winter onions. We should choose a position that gets as much of the winter sunshine as possible, and the kind of onion to sow at this time is the Tripoli.

Another crop, the seed of which we may sow now, is the winter spinach; very often it is sown on the ground that has been occupied by the potatoes. It is important to sow thinly, and when the seedlings are well up, it is necessary to thin out the little plants until they stand six inches apart in the rows.

During this month many people also sow a row or two of turnips, so as to have young roots for use during the winter; but in small gardens we cannot grow everything, so we must make our choice, and decide which will be most acceptable in the kitchen.

But still we have not come to the end of the vegetable seeds we might sow, and mention may well be made of lettuces. The kind to select is known as the brown cos lettuce, as this is the most likely to stand the severity of the winter. It is never a very certain crop, and some people take the precaution of putting a cold frame over the plants when the sharp weather sets in. Others, again, let them take their chance, and more often than not, when the soil is not unusually heavy and cold, most of the plants are strong and healthy in the spring, and may then be planted out. These, of course, are a considerably earlier crop than those not sown until the spring.

If we are thinking of planting a strawberry bed, the soil must be made ready. We must dig it deep and put in some well-rotted manure, and after that it is as well to tread it. Half the secret of getting the plants to take quickly to the soil is to plant them firmly.

If the out-of-door tomatoes are ripening quickly now, we may pick those that are ruddy, and finish ripening them in a sunny window, or, better still, in a greenhouse or conservatory, as near to the glass as we can get them. Of course, they must be partially colored before we pick them. We must still keep a look-out for side growths, and remove them as soon as they appear. If the plants are bearing fruit very plentifully, it is well to feed with liquid manure well diluted with water. We need not give this every day, but only alternately with plain water.

Perhaps the patty-pan squashes are now showing fine large fruits, and we must remember that there is no need to let these remain on the plants after they have reached a fair size, as the plants will be all the better without them. Young immature squashes, freshly picked, are a great deal nicer to eat than those that have fully matured their seeds.

A FLORAL BAROMETER

ON another page we read how to make artificial flowers. We can turn the art to account in a practical fashion, and make a bouquet of paper flowers that will tell us what the weather is going to be. So let us make some flowers out of pink paper, and some others out of blue paper. Any kind of flowers will do, so long as we use these two colors. We can make either a big or a small bouquet.

Now we purchase from a druggist a few cents worth of chloride of cobalt, and dissolve it in water. When it is dissolved, we dip the flowers into the solution we have made, then hang them up to dry. If the solution is weak, we may dip them in a few times, letting them dry before every repetition of the bath. That is all we need. The floral barometer is ready for its work. When the weather is going to be damp, the flowers made of pink paper will remain pink; but when it is going to be dry, they will change into a purple color. Also, the flowers made from blue paper will remain blue when the weather is going to be wet, but when it is going to be dry they will turn to green. This floral barometer is fairly reliable, and is more reliable than many expensive instruments to foretell the weather.

The paper bouquet, when coated with the solution of chloride of cobalt, as we have described, becomes what is called by scientific men a *hygrometer* which means measurer. of moisture, and which comes from two Greek words—*hygros*, moist; and *metros*, a measure. A bit of seaweed fresh from the sea forms a very good hygrometer. This is crisp and dry in warm weather, and moist and clammy in wet weather. This is caused by the salt that remains on it; the salt takes in moisture from the air when the air is moist, and, when the air is dry, so is the seaweed and the salt. If our senses were keen enough we could tell when the air is moist or dry, but our senses are not nearly keen enough to detect little changes, and careful students of chemistry and of Nature have found out that the effect upon other objects, such as salt seaweed, is much greater than it is upon men and women and boys and girls, so that by studying seaweed and other things we can tell what changes the air is undergoing, and so can tell what kind of weather we are going to have.

THE NEXT THINGS TO MAKE AND THINGS TO DO ARE ON PAGE 4039

A FAMOUS STORY OF A GOOD MAN

IT is over half a century since "John Halifax, Gentleman" was written, and, as it is still one of the most widely read of English stories, it certainly deserves to be included among the famous books written by English authors. Not that it is in every way a great story, for it is remarkably lacking in incident and movement. It depends entirely for its interest on the character of its hero, who is, in every sense, an example of true manliness, a Christian gentleman. The fact that its author can interest us in her hero with so quiet a story is all the more to her credit. "John Halifax, Gentleman" was written and published in 1857 by a lady named Dinah Maria Mulock, who was then thirty-one years of age, and who had earlier written several stories. Some years later she married a gentleman named Craik, and sometimes her married name is given on the title-page of this, the most famous of her books. Mrs. Craik died on October 12, 1887.

JOHN HALIFAX, GENTLEMAN

CONTINUED FROM 3839

"GET out o' Mr. Fletcher's road, you idle, lounging, little——"

"Vagabond" was no doubt what Sally Watkins, the old nurse of Phineas Fletcher, was going to say, but she had changed her mind in looking again at the lad, who, ragged, muddy, and miserable as he was, was yet anything but a "vagabond."

A downpour of rain had drawn Mr. Fletcher and his son Phineas to shelter in the covered alley that led to Sally's house, on their way home. Mr. Fletcher pushed the little hand-carriage in which his weak and ailing son was seated into the alley. The ragged boy, who had also been sheltering there, lent a hand in bringing Phineas out of the rain, Mr. Fletcher saying to him kindly, after Sally's outburst, "Thee need not go into the wet, my lad. Keep close to the wall, and there will be shelter enough both for us and thee."

Mr. Fletcher was a Quaker, as will be seen from his form of speech and his consideration for the poor boy. He was a wealthy tanner in the town of Norton Bury, and in every sense a good man, who, though prosperous in business, had suffered sorrow in his life. His wife had died, leaving him with their only child, Phineas, now a sickly boy of sixteen.

The ragged lad, who had seemed very grateful for the Quaker's kind words to him, stood leaning idly against the wall, looking at the rain that splashed on the pavement of the High Street. He was a boy of perhaps fouteen years; but, despite his serious and haggard face, he was tall and strongly built, with muscular limbs and square, broad shoulders, so that he looked a lad of seventeen or more. The puny boy in the hand-carriage, the child of a wealthy man, who had had all the care that money could secure, was filled with admiration for the manly bearing of the poor lad; for, in common with all people who are not physically strong, he admired a youth of manly appearance.

After some time the rain gave promise of ceasing, and Mr. Fletcher, pulling out his great silver watch, which had never been known to be wrong,said:

"Twenty-three minutes lost by this shower. Phineas, my son, how am I to get thee home? Unless thee wilt go with me to the tanyard——"

The boy in the hand-carriage shook his head, and his father then called out to Sally Watkins if she knew of anyone who would wheel him home. At the moment old Sally did not hear, and the ragged boy mustered courage to speak for the first time.

"Sir, I want work; may I earn a penny?" he said, taking off his tattered old cap and looking straight into Mr. Fletcher's face. The old man scanned the honest face of the lad very closely.

"What is thy name, lad?"

"John Halifax."

"Where dost thee come from?"

"Cornwall."

"Hast thee any parents living?"

The lad replied that he had not, and to many other questions with which Mr. Fletcher plied him he returned straightforward answers. The tanner promised him a groat if he would see Phineas safely home when the rain had ceased, and asked him if he would care to take the piece of silver now.

THE LITTLE GIRL WHO CUT A SLICE OF BREAD FOR POOR JOHN HALIFAX

"Not till I've earned it, sir," said the Cornish lad. So Mr. Fletcher slipped the money into his son's hand and left them. Only a few words were spoken between the two boys for a little while after he went away, and John Halifax stood idly looking across the narrow street at the mayor's house, with its steps and porticoes and its fourteen windows, one of which was open, showing a cluster of little heads within. The mayor's children seemed to be amused, watching the shivering shelterers in the alley; but presently a somewhat older child appeared among them, and then went away from the window quickly. Soon afterwards the front door was partly opened by someone whom another was endeavoring to restrain, as the boys on the other side of the street could hear loud words from behind the door.

"I will! I say I will——"

"You sha'n't, Miss Ursula!"

"But I will!" And there stood the little girl, a loaf of bread in one hand, and in the other a carving-knife with which she succeeded in cutting a large slice from the loaf.

"Take it, poor boy! You look so hungry," she said. "Do take it!" But the door was shut again upon a sharp cry of pain; the headstrong little girl had cut her wrist with the knife.

THE BEGINNING OF GOOD FORTUNE AND HAPPINESS FOR THE WANDERING BOY

After a little, John Halifax, who was clearly famished for want of food, went across the street and picked up the slice of bread which had fallen on the doorstep. In those days poor folk rarely tasted wheaten bread at all, and probably the Cornish lad had not eaten a morsel of it for months. He now ate the slice very slowly, and looked very thoughtful all the while. This was the beginning of all that made for happiness and good fortune in the life of John Halifax, as we shall discover in due time.

From the moment Phineas had set eyes on him he liked the lad. The invalid boy lived a very lonely life, with no playfellows and no friends of his own age, and he longed to make a friend of this strong-looking, honest youth who had so suddenly come into his life. John was so tender in the way he helped Phineas home that the Quaker boy felt sure he would be a worthy friend.

It appeared that John had heard of his father as a sad, solemn sort of man, much given to reading. He had been described to John as "a scholar and a gentleman," and the lad had determined that he, too, would be a scholar and a gentleman. He was only an infant when his father died, and his mother, who had been left very poor, had a sore struggle until she died, when John was only eleven years old. Since then the lonely boy had been wandering about the country getting odd work to do at farms, and at other times almost starving.

JOHN HALIFAX DETERMINES TO BE A GENTLEMAN LIKE HIS FATHER

Thus he had wandered to Norton Bury; and now, thanks to Phineas, Mr. Fletcher gave him a job at the tannery, although at first he was not altogether sure of John's character.

It was not long, however, before the two lads were fast friends, and spent much of their time together. John Halifax could read, but he had not yet learned to write; so Phineas, who had been well educated, became his friendly tutor, and repaid his devotion by teaching him all he knew.

One day John took from his pocket a little case of leather, with an inner one of black silk, which enclosed a book. This was the one treasure he had carried about with him since his mother's death; and he would not let it go out of his hand, but held it so that Phineas could see the leaves. It was a Greek Testament, on the fly-leaf of which was written, after the old English fashion:

"Guy Halifax, his book.

"Guy Halifax, gentleman. Married Muriel Joyce, spinster, May 17, in the year of our Lord 1779.

"John Halifax, their son, born June 18, 1780."

There was one more entry, in a feeble, illiterate hand:

"Guy Halifax, died January 4, 1781."

Giving Phineas a pen, but never once letting go of the precious book, John asked him to make another entry on the same page:

"Muriel Halifax, died January 1, 1791."

That was all Phineas ever heard of the boy's parentage, nor did John know more about it himself. He was indebted to no forefathers for a family history; his pedigree began and ended with his own honest name—John Halifax. But his father had been a gentleman, and he meant to be a gentleman too.

John Halifax did not like the work he had to do at the tannery, where his days were passed among dirty and evil-smelling things; but, none the less, he did his duties faithfully, and never shirked a task. At times the desire rose in him to go away and try to find some better occupation; but when he read "The Pilgrim's Progress" he saw that the path of duty was never easy to follow, and so he continued his labors in the tannery with a stout heart.

JOHN HALIFAX DOES HIS DUTY FAITHFULLY AND IS NOT WITHOUT REWARD

The result was that, as the years passed, and old Mr. Fletcher found him worthy of the highest trust, John became manager of the business, and went to live in the house of his employer. In knowledge, too, he had grown, for Phineas had been a good tutor, and John was so apt and studious that before long Phineas confessed that his pupil knew more than he.

One day when they were having an open-air lesson on a hill above the River Avon, they saw a boat in such distress that its occupants were in danger of drowning. John managed to effect their rescue; and one of them, Squire Brithwood, a haughty, conceited person, instead of thanking his rescuer, threw him a piece of money, which John threw back at him. The other, who seemed indignant at the way the squire had treated the boy, inquired of John who he was and what he did; but seemed disappointed on hearing that he was only a worker in Fletcher's tanyard.

"My name is March—Henry March," said the gentleman. "If you should ever—"

"Thank you, sir. Good-day!" was all that John would say, and so the matter ended.

Some years after this John and Phineas spent the summer days at the rural village of Enderley, where they lived at Rose Cottage. Enderley was not far from Norton Bury, and every day John rode there to look after the tannery and the flour-mill which had recently been added to Mr. Fletcher's now flourishing business.

HAPPY SUMMER DAYS AT ROSE COTTAGE IN THE COUNTRY

Now, Rose Cottage was really two houses, in one of which the young men lived, while an invalid gentleman and his daughter occupied the other. John Halifax had noted this young lady occasionally in his walks across the breezy downs which surrounded the place, and thought her the sweetest creature he had seen. When he learned that her name was Ursula, he was thrilled with happy memories of the little girl who had thrown him the slice of bread, for he had heard her called by that same name, and wondered if this might be she grown into a young woman.

Ere long he learned to know his pretty neighbor, and became her companion in their rural walks. No artist ever painted a more attractive picture than these two made as they walked briskly across the wind-swept uplands; she with her sparkling dark eyes, her great mass of brown curls escaping from her hood, and John with his frank, ruddy face, and his fine, swinging, manly figure.

WHY URSULA LEFT ROSE COTTAGE AND JOHN HALIFAX WAS SAD

Ursula's father, who had been ill when he went to the cottage, died suddenly, and was buried in Enderley churchyard. He was the same Henry March whose life John saved that day when the Avon was in flood. He was cousin to Squire Brithwood; and, unhappily, Ursula's fortune was left in the keeping of that haughty and unchristian person. The squire's wife, Lady Caroline, was a light-headed, senseless woman, as much talked about in Norton Bury for her foolish conduct as her husband was notorious for his drunkenness. Yet it was to the care of such as these that Henry March had left his daughter, though he had intended to appoint another guardian to look after her.

John was very sad at the thought of Ursula leaving the cottage for the squire's home at Mythe House, for he knew that she had been happier there in the sweet country retreat than she would ever be in the ill-conducted household of her guardian. She, too, had regrets at the thought of going—John and she had become fast friends.

JOHN HALIFAX TELLS URSULA THAT HE IS ONLY A TANNER'S APPRENTICE

John told her that Mr. Brithwood would prbably deny his right to be considered a friend of hers, and would not allow his claim to be thought a gentleman, even though a poor one. In answer to her expression of astonishment, he said:

"It is right, Miss March, that you should know who and what I am to whom you are giving the honor of your kindness. Perhaps you ought to have known before; but here at Enderley we seem to be equals—friends."

"I have indeed felt it so."

"Then you will the sooner pardon my not telling you—what you never asked, and I was only too ready to forget—that we are *not* equals—that is, society would not regard us as such, and I doubt if even you yourself would wish us to be friends."

"Why not?"

"Because you are a gentlewoman, and I am a tradesman."

The news was evidently a shock to her. It could not but be, reared as she had been. She sat—the eyelashes dropping over her flushed cheeks—perfectly silent. John's voice grew firmer, prouder; there was no hesitation now.

THE LITTLE GIRL WHO GAVE JOHN HALIFAX BREAD WHEN HE WAS STARVING

"My calling is, as you will soon hear at Norton Bury, that of a tanner. I am apprentice to Abel Fletcher, Phineas's father."

"Mr. Fletcher!" She looked up at him, with a mingled look of kindliness and pain.

"Ay, Phineas is a little less beneath your notice than I am. He is rich, and has been well educated; I have had to educate myself. I came to Norton Bury six years ago—a beggar-boy. No, not quite so bad as that, for I never begged. I either worked or starved."

The earnestness, the passion of his tone, made Miss March lift her eyes, but they fell again.

"Yes, Phineas found me starving in an alley. We stood in the rain opposite the mayor's house. A little girl—you know her, Miss March—came to the door and threw out to me a bit of bread."

Now indeed she started.

"You! Was that you?"

"It was I!"

John paused, and his whole manner changed into softness as he resumed:

"I never forgot that little girl. Many a time, when I was inclined to do wrong, she kept me right—the remembrance of her sweet face and her kindness."

That face was pressed down against the sofa where she sat. Miss March was all but weeping.

John continued:

"I am glad to have met her again, and glad to have been able to do her some small good in return for the infinite good she once did me. I shall bid her farewell now, at once, and altogether."

A quick, involuntary turn of the hidden face seemed to ask him "Why?"

THE ILLNESS OF JOHN HALIFAX AND A DREAM THAT CAME TRUE

"Because," John answered, "the world says we are not equals; and it would be neither for Miss March's honor nor mine did I try to force upon it the truth—which I may prove openly one day—that we *are* equals."

Miss March looked up at him—it were hard to say with what expression, of pleasure, of pride, or simple astonishment; perhaps a mingling of all; then her eyelids fell. She silently offered her hand, first to Phineas, and then to John. John pressed it, and rose. His hand was on the door, but he could not go.

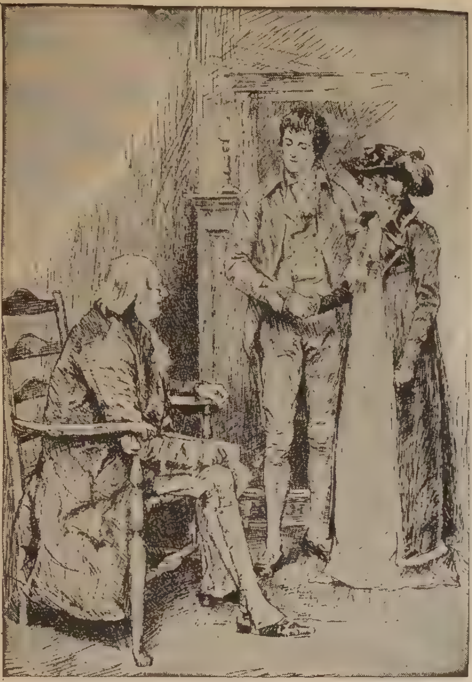
"Miss March," he said, "perhaps I may never see you again—at least, never as now. Let me look once more at that wrist which was hurt."

Her left arm was hanging over the sofa, the scar being visible enough. John took the hand, and held it firmly.

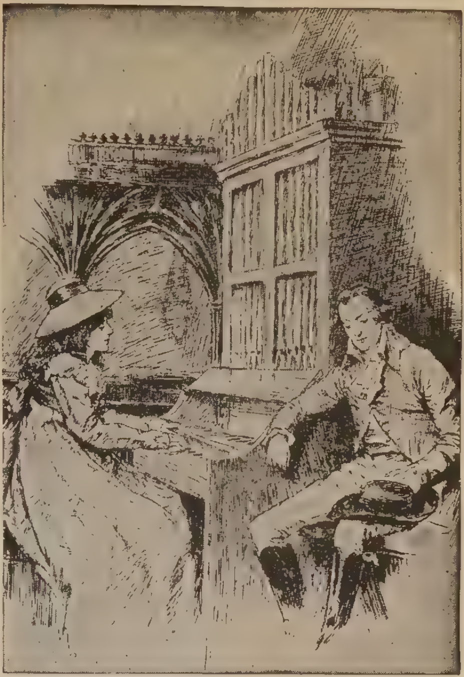
"Poor little hand—blessed little hand! May God bless it evermore!"

Suddenly he pressed his lips to the place where the wound had been, a kiss long and close, such as only a lover's

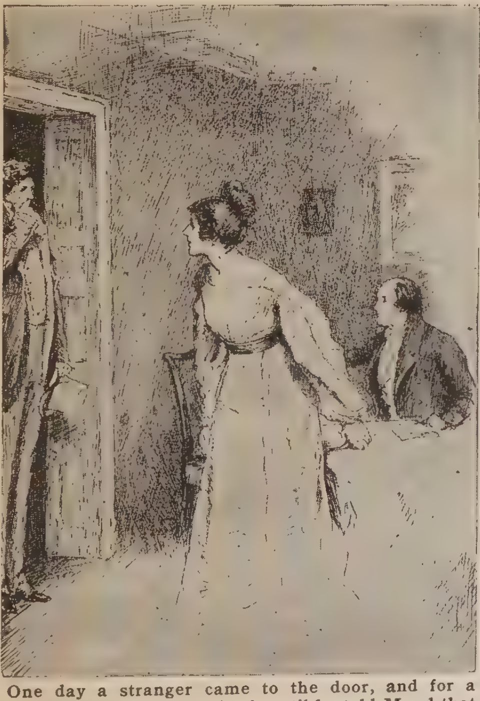
SCENES FROM JOHN HALIFAX, GENTLEMAN



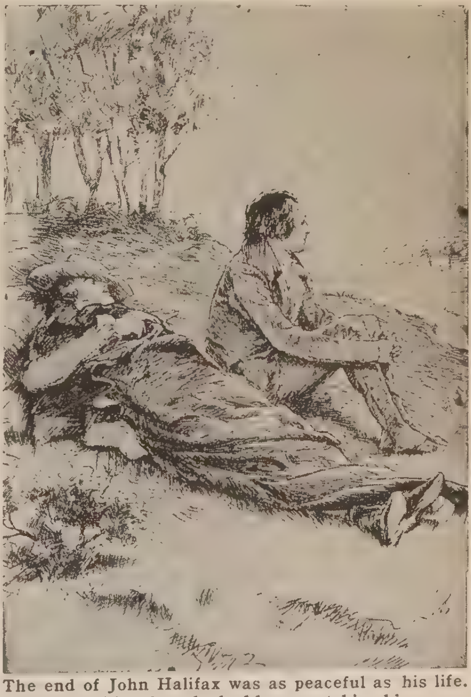
John Halifax and his sweetheart Ursula, having determined to be married came to old Mr. Fletcher, who had been so good a friend to them, for his blessing.



Young Lord Ravenel, the son of the Earl of Luxmore, loved to sit and listen to Muriel, the beautiful blind daughter of John Halifax, playing on the organ.



One day a stranger came to the door, and for a moment was coldly received, until he told Maud that he was her brother Guy come back from America.



The end of John Halifax was as peaceful as his life. On the hillside, where he had been watching his young people, he fell into the sleep that knows no waking.

kiss could be. Surely she must have felt it—known it. A moment afterwards he was gone. That day Miss March departed, and John and Phineas remained at Enderley alone.

After John Halifax returned to Norton Bury he was seized with illness, and for a time it looked as if he might not recover. In his delirium he called aloud for Ursula, and dreamed that she had come to sit beside him and asked him to live for her sake. Phineas, in his anxiety for his friend, brought Ursula to him, and the dream came true, for she did ask him to live for her sake. He recovered at length, and became Mr. Fletcher's partner.

Going to London on behalf of the business, John there met the great statesman, Mr. Pitt, who was impressed with the natural abilities of the young man. His reputation for honesty and sound common-sense had now grown so great in Norton Bury, that when he returned there he found himself one of the most respected men in the town.

THE MARRIAGE OF JOHN AND URSULA AND THE FORTUNE DENIED THEM

Although he was still far from being rich, he was no longer a poor worker, and as Ursula was willing to share his life, they boldly determined to be married, in spite of her guardians, who asserted that John should never touch a penny of Ursula's fortune. They contrived, however, to be happy without it, for John refused to go to law to recover his wife's money, and was determined he would work honestly to support her. Lady Caroline would have been friends with them, but he wished to have nothing to do with her, or the class of people who were her associates.

With the death of old Mr. Fletcher, however, came misfortune, for it was found that the tannery was no longer a paying property, and there were only the mills to go on with. The temptation now was strong, in the face of his difficulties, for John to claim his wife's fortune, illegally held by Squire Brithwood. But he resisted it, and determined to struggle on.

At this time Ursula's relative, Lord Luxmore, who was anxious to see the Catholic Emancipation Bill passed, thought he could use John Halifax for his purpose by offering to have him returned to Parliament for the "rotten borough" of Kingswell, the member for which was then elected by only fifteen voters. Twelve of these were tenants of Lord Luxmore, and the other three of Phineas. But although John would have supported the Bill, he was too honest to permit himself to be elected to such a seat, as all honest men were then agitating to abolish these "rotten boroughs."

JOHN HALIFAX'S HONESTY IS PUT TO THE TEST AND FOUND TRUE

So he declined, and Luxmore next tried to win him over by offering him the lease of some important cloth-mills he owned; but these John would not take on credit, and he had no money to pay for them. So Ursula now determined to tell Lord Luxmore all about the way her fortune had been kept from them; and the result was that Lord Luxmore went to Brithwood and made him turn over the money to her. When John purchased the lease of the mills, Lord Luxmore thought he had secured him firmly, and that John would use his great and growing influence with the people of the district to further Luxmore's political schemes.

While all this was going on, young Lord Ravenel, the son and heir of Luxmore, had been a constant visitor at the Halifax home, and delighted in the company of John's daughter, Muriel. Halifax had now three children: two boys, named Guy and Edwin, and Muriel, who alas! had been born blind. Perhaps on account of her infirmity she was the pet of her parents; but she was of a gentle and affectionate nature, and was also beautiful to look upon, even with her sightless eyes. Young Ravenel was also a gentle youth, and, like Muriel, was fond of music.

THE INDEPENDENCE OF JOHN HALIFAX AND HOW HE MET OPPOSITION

The time for the election of the member for Kingswell had now come round, and as Luxmore had failed to induce John Halifax to stand, he put up another person, who would do just as the earl wanted. But he was greatly mistaken in supposing that John would use his influence to make the handful of voters, most of whom were employed in his mills, vote for Luxmore's man. Instead of that, Halifax advized them to be honest, and vote as they thought right; with the result that Lord Luxmore evicted them from their homes, as was often done in England before the reform of political voting. But John found new homes for them, and everything prospered with him.

As his riches increased, he bought a stately country mansion, named Beechwood, not far from Rose Cottage, which was ever dear in memory to him. Another son, Walter, was born to him, and everything seemed to smile on him in his beautiful country home.

DESPITE UNFRIENDLY OPPOSITION, JOHN HALIFAX GROWS IN PROSPERITY

Luxmore now sought to injure him by diverting the water from his cloth-mills, and leaving his great wheels idle. Of course, Halifax could have taken him to law; but, instead of that, he simply set up a steam-engine, which was then a great novelty; and his mills did better than ever.

Luxmore, finding it useless to fight against the resourceful Halifax, went abroad, and left his son, Lord Ravenel, alone at Luxmore Hall. The young man, despite his father's unfriendly conduct, was still a frequent visitor at Beechwood, and when poor Muriel died, his grief at her loss was only less than that of her parents.

The years passed by, and happiness still reigned at Beechwood; but little had been seen of Ravenel, until one day John Halifax met him, greatly changed from the gentle youth of the past, at Norton Bury. John invited him to ride over with him to Enderley.

"Enderley? How strange the word sounds! Yet I should like to see the place again," said Ravenel, who decided to accompany John Halifax and Phineas Fletcher in the drive back to Beechwood. It was a cold and bitter night in early winter, and Ravenel wrapped himself closely in his furs as they drove along the turnpike road.

THE ATTACK IN THE NIGHT. AND HOW JOHN HALIFAX ACTED

He inquired kindly for all the family, and was told that Guy and Walter were as tall as himself, while the daughter——

"Your daughter?" said his lordship, with a start. "Oh, yes; I recollect—Baby Maud. Is she at all like—like——"

"No," said John Halifax. Neither said more than this; but it seemed as if their hearts warmed to one another, knitted by the same tender remembrance.

At an unfrequented part of the road the carriage was set upon by a number of men, who, seizing the horses, shouted out that they wanted money. The times were hard, and these were some of the unemployed laborers of the countryside, who, in desperation and folly, thus sought to extort money from the wealthy John Halifax. But the master of Beechwood showed Lord Ravenel how firmness and gentleness could win the hearts even of one's enemies.

The horses, plunging and rearing in the darkness, knocked down one of the men, and while Ravenel would have had Halifax whip ahead at this moment, John, quieting the horses, leaped down to the ground, and lifted the man up with the assistance of some of his fellows. Examining his injuries by the light of the carriage lights, he found, to his sorrow, that he had been killed. The other men were so amazed by this act, and especially when Halifax had the dead man wrapped in one of the rugs from the carriage and insisted on going with him to his home, that they all felt guilty for their unwarranted assault on the unoffending mill-owner.

LORD RAVENEL'S PROPOSAL AND SOME GOOD ADVICE TO THE YOUNG LORD

John Halifax, on his part, promised to do all he could to help them, and thus not only taught them a lesson in good conduct, but proved to Lord Ravenel that the "lower orders," even in their misguided folly, were worthy of something better than being ridden down by rich men's carriages.

Lord Ravenel had returned to reside again at Luxmore Hall, and his visits to Beechwood became as regular as they had been in the old days at the Halifax home, when Muriel was alive. It was the society of Maud in which Ravenel now delighted, though he never forgot the serene and happy days he had spent with her blind sister, who was no more.

It was not altogether to the liking of Mr. and Mrs. Halifax when they discovered that their second son, Edwin, loved Miss Silver, the governess. But John Halifax was not the man to allow any false feeling of pride to stand in the way of his son's happiness, and so the old Norton Bury house was given to Edwin and his bride, for them to begin housekeeping where John and Ursula had begun before them.

Soon after this, Lord Ravenel sought to be regarded as suitor for the hand of Maud, who would thus have become the future Countess of Luxmore. He said that he would wait two years for her, if her father wished it; but John Halifax would make him no promise, and urged him rather to endeavor first to become a more worthy man, so that he might do something to redeem the evil reputation which the conduct of his own father had brought upon the name of Luxmore.

"Do you recognize what you were born to be?" said Halifax to him. "Not only a nobleman, but a gentleman; not only a gentleman, but a man —man made in the image of God. Would to Heaven that any poor word of mine could make you feel all that you are—and all that you might be!"

THE YEARS PASS BY AND THERE IS HAPPY NEWS OF GUY HALIFAX

"You mean, Mr. Halifax, what I might have been—now it is too late."

"There is no such word as 'too late' in the wide world—nay, not in the universe," said John Halifax.

Lord Ravenel for a time sat silent; then with a sudden effort he rose to go, and, thanking Mrs. Halifax for all her kindness, he said, in a voice choked with emotion:

"For your husband, I owe him more than kindness, as perhaps I may prove some day; if not, try to believe the best of me you can. Good-bye!"

It was not many weeks after this that the old Earl of Luxmore died in France, and it then became known that his son, who succeeded to the title, had voluntarily given up his claims on the estate in order to pay the heavy debts of his worthless father.

The home at Beechwood had lost another inmate when Guy first went to Paris and later sailed for America. Years passed by, and he became a successful merchant in Boston, and then one day he wrote home to say he was coming back to the Old Country to be with his father and mother again, and was bringing with him the partner in his business.

The ship in which Guy and his friend sailed from America was wrecked, and Ursula, in her grief at the supposed loss of her eldest son, seemed to be wearing away, when one day a strange gentleman stood in the doorway—tall, brown, and bearded—and asked to see Miss Halifax. Maud just glanced at him, then rose from her chair, and said somewhat coldly:

"Will you be seated?"

"Maud, don't you know me? Where is my mother?"

The return of the son whom she had given up for dead brought joy again to the heart of Ursula, and her health seemed to revive, but it was clear that the number of her days was now uncertain.

YOUNG LORD RAVENEL PROVES THAT JOHN HALIFAX WAS RIGHT

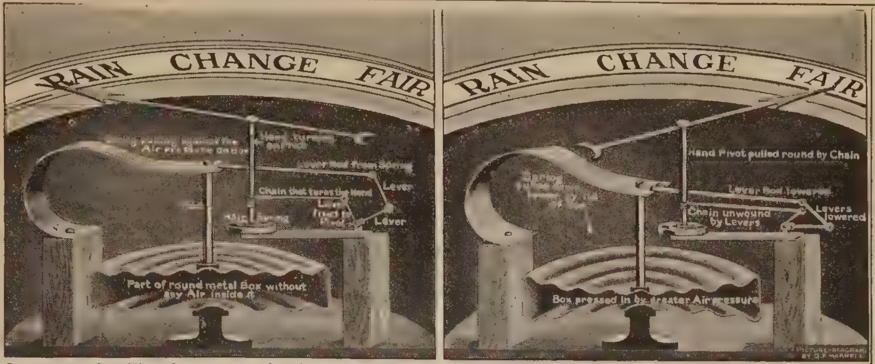
Scarcely less than the delight in Guy's return was the discovery that his partner was none other than the new Earl of Luxmore, who, as plain Mr. William Ravenel, had by his life in America proved John Halifax was right when he said it was not too late for him to model his life on lines of true manliness. He had, indeed, become all that John had desired of him—a man and a gentleman —so that Maud was, after all, to be the Countess of Luxmore.

But the days of John Halifax himself were now drawing to a close, and he was not without premonitions of his end; for in his talks with Phineas Fletcher, who had remained his faithful companion all these years, he spoke as one would speak of a new abode, an impending journey. Death came to him very gently one day at sunset, just after he had greeted Phineas with a smile when his old friend, looking towards Lord Luxmore and his future bride, who were with a group of the young people, had said:

"I think sometimes, John, that William and Maud will be the happiest of all the children."

THE PEACEFUL END OF A NOBLE AND BEAUTIFUL LIFE

He smiled at this, and a little later seemed to fall asleep; but when Maud came up and spoke to him, he was dead. While he was sleeping thus, the Master had called him. His sudden end was so great a shock to the frail life of Ursula, that in a few hours she followed him. When they buried John Halifax in the pretty Enderley churchyard they laid his wife of three-and-thirty years to rest beside him.


RAIN
CHANGE
FAIR
Air pressure on Box
Chain that turns the Hand
Lever
Lever
Part of round metal Box without any Air inside it
RAIN
CHANGE
FAIR
Hand Pivot pulled round by Chain
Chain unwound by Levers
Levers lowered
Box pressed in by greater Air pressure
PICTURE-DIAGRAM BY G.F. MORRELL

One very familiar barometer is the aneroid barometer. The first picture shows its various parts and the second shows how these work. The air presses down with greater or less force upon the metal box, from which all the air has been exhausted, and this moves the hand, or indicator.

THE PRESSURE OF THE AIR

CONTINUED FROM 3888

WE are all aware that there are many different kinds of pressure. For instance, we realize what it is to press with the finger against anything, and whenever we use the word pressure, that is the kind of idea we may have in our minds. When we hold anything in the hand, we feel its pressure due to gravitation; and that is a kind of pressure which we know well, and which applies equally to all the different states of matter: solid, liquid, and gaseous. We also know that there is another kind of pressure exerted by rays, or radiation, in the ether, such as light, which is therefore called radiation pressure. We mention this kind of pressure because the discovery of it bears so greatly upon our ideas as to what must be the consequences of gravitation some day.

We must now pass on to the consideration of some other kinds of pressure, and we shall see that here we have again to learn of measurement. Just as we had special means for measuring gravity and specific gravity, and so forth, so special means have been invented for measuring the kinds of pressure we are about to discuss.

We speak of matter as either solid or liquid or gaseous; but of these three states in which we may find matter, two are much more like each other than either is like the third. Water is very different from the air above it; but there is one very important respect in which the water and the air are far more like each other than either of them is like the solid ground, and that is that they will both of them run, or flow.

In the solid ground there are forces holding together the molecules, so that the shape of the whole is maintained; but the shape of the air or water—if we can speak of such a thing—changes from moment to moment if it is allowed to, because both air and water flow. So liquids and gases are known in the language of science as fluids, which simply means things that flow. In ordinary language, liquid and fluid mean the same thing; but the point for us to understand is that gases also have to be reckoned as fluids, because, like liquids, they flow.

Now, in any fluid, at any time, and at any place, there is a certain pressure which is called fluid pressure, and there is at least one instance of fluid pressure which we have all measured many times, though perhaps we did not know that we were doing so. That is the pressure of the air.

This atmospheric pressure, as it is usually called, is by far the most important kind of fluid pressure for our lives; and we must spend a little time in studying it carefully. We know that we really live at the bottom of a great ocean of air. On the floor of this ocean we live and crawl about, and if we can swim in it for a little while at a small height—as we do in flying machines—we are very proud of ourselves.

HOW THE AIR PRESSES INTO OUR LUNGS AND ENABLES US TO LIVE

Everywhere in this immense ocean there is fluid pressure. Perhaps the first and most important consequence of this fluid pressure is that it enables us to breathe. What happens when we breathe is that we make a movement which tends to empty the space in our lungs of everything; but as that space is in communication with the outer air, the atmospheric pressure drives some of that outer air into the space we make. Thus, without the atmospheric pressure we could not breathe, and, therefore, could not live.

Now, it is only some three hundred years ago since, in studying a case like this, men said that the reason why air or anything else would rush into an empty space, if it could, was that Nature objected to anything being empty. The phrase which they used, and which they accepted as an explanation, was *Nature abhors a vacuum*—vacuum being simply the Latin for an empty place. But, just about three centuries ago, it was discovered why Nature abhors a vacuum, and also to what extent Nature abhors a vacuum. It was found that what really happens is always the consequence of fluid pressure. We owe this great discovery not directly to Galileo himself, but to another Italian named Torricelli, the most famous of Galileo's pupils.

We all know that it is possible by means of a pump to pull up water; and it was found that there was a certain height to which water would rise in a pump—about thirty feet.

A FAMOUS ITALIAN WHO DISCOVERED THE GREAT SECRET OF THE ATMOSPHERE

But no pump will make water rise, say, fifty feet. Thus it was remarked that there is a limit to Nature's dislike of a vacuum! Torricelli thought that other fluids would behave as water does. He thought, also, that the water rises in a pump because of the pressure of the atmosphere, and that if he took a much heavier fluid than water, it also would rise, but, being heavier, would rise so much less. He took the heaviest of all fluids, which is mercury, and he proved that the mercury does rise in the same way as water does, but to a much lower height in proportion, as mercury is heavier than water.

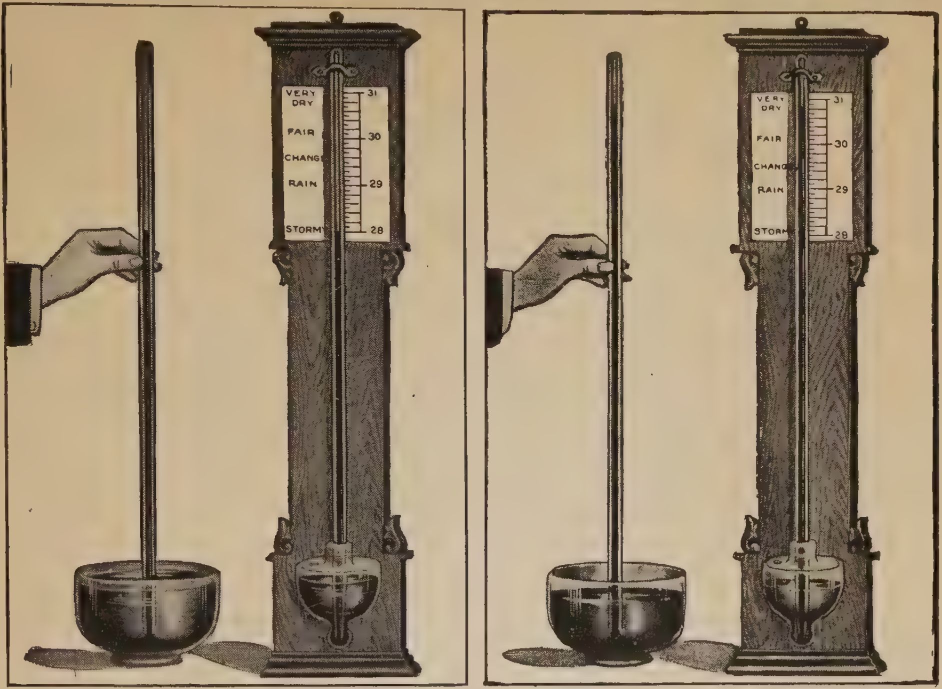
It is very easy to understand the famous experiment of Torricelli, which proved, for the first time, the existence of the atmospheric pressure, and explained why it is that Nature abhors a vacuum. If we take a fine glass tube and fill it with mercury, and then turn it upside down in a cup that already contains mercury, what will happen to the mercury inside the tube? We might expect that all the mercury would run out of the tube into the cup; but, in point of fact, it does not. Something holds up the column of mercury in the tube. The earth, we know, is pulling by gravitation upon that column of mercury. What is the opposing force that holds it up? The answer is that it is the atmospheric pressure pressing down upon the surface of the mercury in the cup, and, so to speak, pressing some of it up into the glass tube.

THE PRESSURE OF AIR THAT WILL BALANCE A COLUMN OF METAL

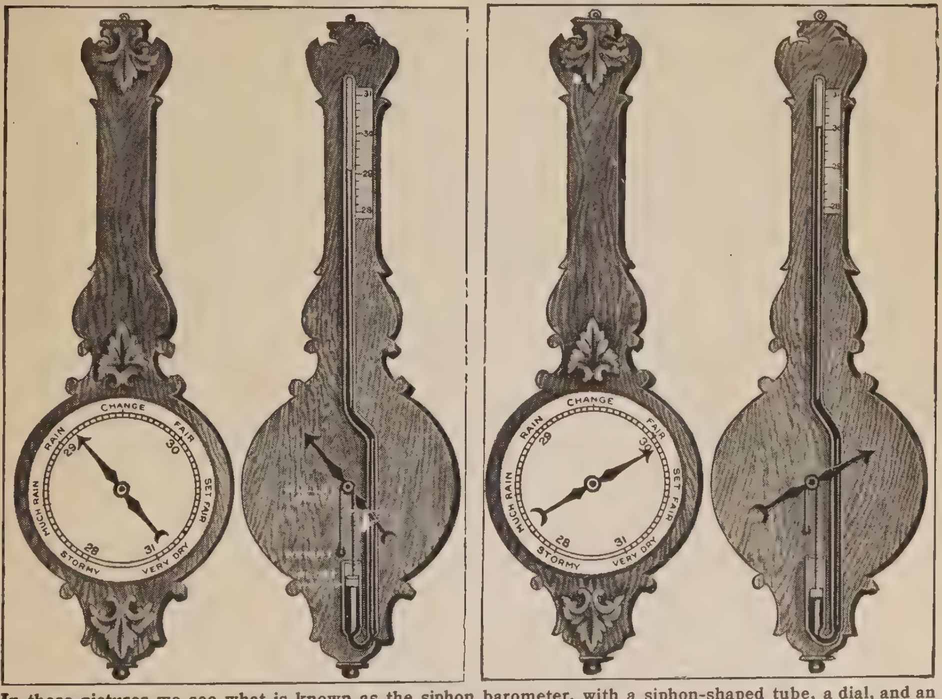
Now, if the tube is short, the mercury will fill it; but if we use a long tube, say, three feet long, and if, having filled it with mercury, we turn it upside down in a cup of mercury, the column of mercury will not be completely held up. On the average, the mercury will drop about six inches. In other words, the pressure of the atmosphere is, as a rule, about equal to supporting a column of mercury thirty inches high.

It is interesting to ask what fills the space in the tube above the level of the mercury when the mercury drops. There cannot be any air there; and we might suppose that there must be nothing there—that it must really be a genuine vacuum. In point of fact, it is as nearly a perfect vacuum as we can obtain, and it has been known, since the time we are speaking of, as a Torricellian vacuum; but it is not perfectly empty, for liquid mercury very easily turns itself into a gas, or vapor, and so, though there is no air in a Torricellian vacuum, it

HOW THE BAROMETER TELLS THE WEATHER


VERY DRY
FAIR
CHANGE
RAIN
STORMY
31
30
29
28

Torricelli, an Italian, first discovered the pressure of the atmosphere. These pictures show his experiment and how it is adapted to the standard barometer. A column of mercury is supported in a tube, standing in a bowl of mercury, by the pressure of air on the mercury in the bowl. When the air is light, the mercury sinks in the tube, as in the first picture; but the pressure of heavy air drives the mercury up, as in the second.


CHANGE
RAIN
FAIR
29
30
MUCH RAIN
SET FAIR
28
31
STORMY
VERY DRY

In these pictures we see what is known as the siphon barometer, with a siphon-shaped tube, a dial, and an indicator. The face has been removed to show how the hand works. As the mercury rises or falls in the open end of the tube, an ivory weight moves up or down, and, by means of a chain over a wheel, turns the hand.

contains a certain amount of the vapor of mercury. It is in some degree possible, by various means, to prevent the mercury from evaporating much; and so we can get in such a tube the nearest approach to empty space that is possible for us, although we may just remind ourselves that, however empty of ordinary matter we make this space, the ether, that fills all space, will even be there.

HOW WE ARE ABLE TO MEASURE THE PRESSURE OF THE ATMOSPHERE

Now, we have noticed that it is possible to measure the length of a column of mercury in one of these tubes, and so, if the atmospheric pressure were greater or less one day than the next, we ought to notice that the column of mercury in the tube is of a different length on the two days. If the atmospheric pressure is high, strong, and pressing down more firmly on the surface of the mercury in the vessel, then it ought to be able to hold up a longer column of mercury; and if the atmospheric pressure is low, it will not hold up such a long column of mercury.

When we think of a man pressing down with his fist on a table, or think of the game people sometimes play at fairs when a man strikes with a hammer upon a knob, and the harder he strikes the higher a weight runs up a pole, we realize what happens in the case of the column of mercury. Thus, this experiment of Torricelli's not only proves the existence of the atmospheric pressure, but it also enables us to measure it.

But, apart from such changes as may occur owing to something happening in the atmosphere, we ought to be able to show that if we rise high up in the atmosphere, the column of mercury in the tube falls, because the higher we rise, the less is the weight of air above us, and the less must be the atmospheric pressure. In the same way the pressure of water increases as we go downwards into the sea, as every diver knows.

WHAT HAPPENED ONE DAY TO A TUBE OF MERCURY ON A MOUNTAIN

A still more famous man than Torricelli, the great French thinker Pascal, made this experiment very shortly after Torricelli's work was begun. He took one of Torricelli's tubes up to a considerable height, and found when he got there that the level of the mercury was much lower than it had been. As he came down again he watched the mercury, and found that its level rose, because there was now a greater pressure of the atmosphere upon the surface of the mercury contained in the vessel. The variation of the atmospheric pressure at different heights has many interesting results. For instance, when men go up in a balloon, they feel the consequences of the steady lessening of the pressure upon which breathing depends, and they may suffer very severely. There is a thing called mountain sickness, which might also be called balloon sickness, and which depends upon this lessening of the atmospheric pressure. A good many people sleep badly at low pressures of the atmosphere—that is to say, when they go among the mountains—and do better at the sea, where, of course, the pressure of the atmosphere is as high as it can be.

It has lately been proved, also by an Italian—and that is quite appropriate—that when people have lived for a few days at some great height, the body produces a greatly increased number of red blood cells—those which carry oxygen from the lungs to the tissues.

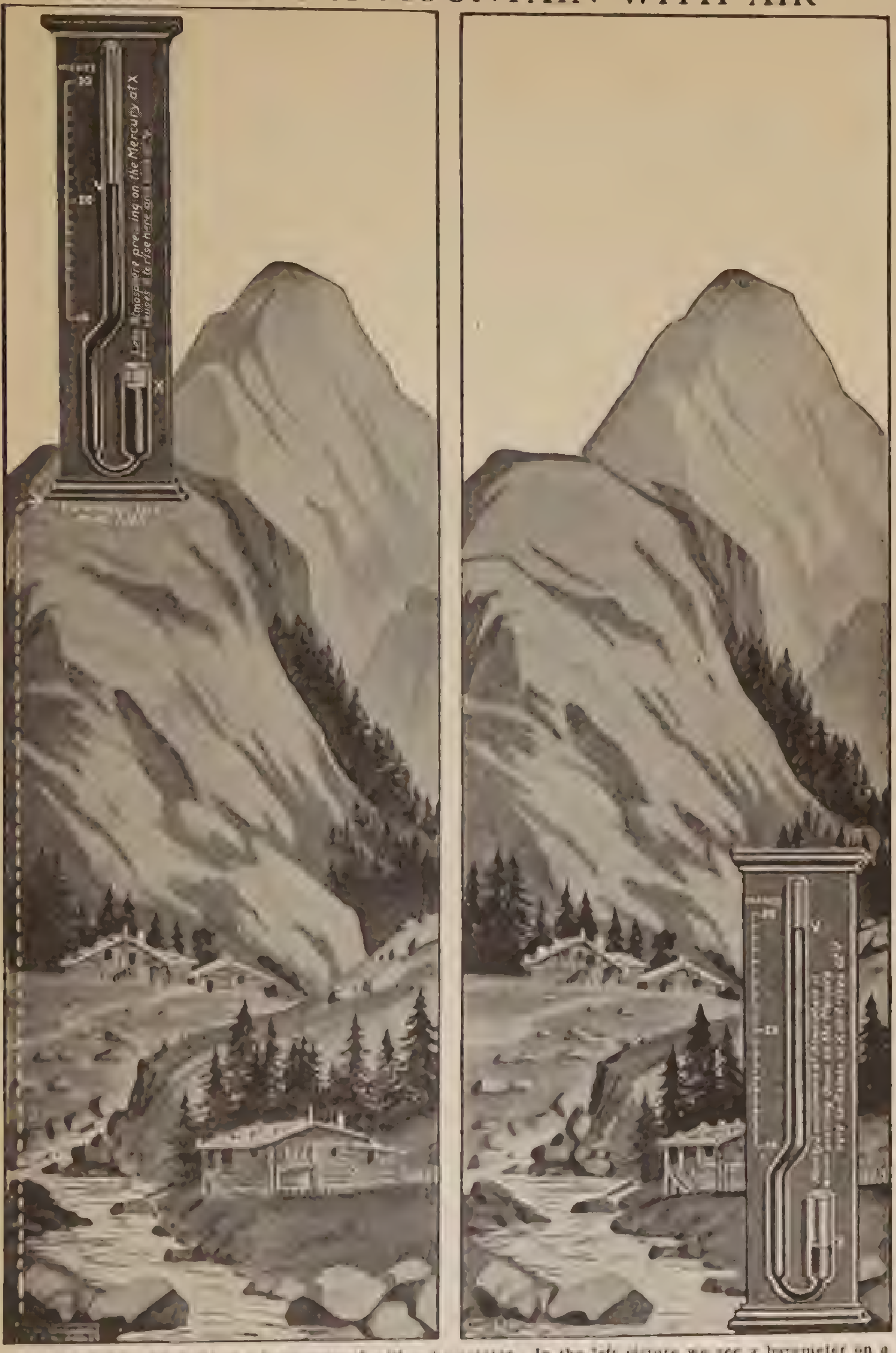
THE WONDERFUL WAY IN WHICH OUR BODY FITS ITSELF TO AIR PRESSURE

On a mountain-top the air is so rare, as we say, or the atmospheric pressure so low, that the body must make special arrangements accordingly. It is very wonderful indeed that the body can adapt itself in this fashion to the altered conditions of the atmosphere.

Now, if in a Torricelli tube we have a means of measuring the pressure of the atmosphere, we have what we may call a barometer, which really means a weight measurer; and that is why it was said just now that there is one kind of fluid pressure which we have all of us measured many times. Every time we have looked at the barometer we have really been measuring the pressure of the atmosphere, for that is all that the barometer does.

No doubt our ordinary way of reading the barometer rather hides what we are really doing. We simply look to see if a little pointer is pointing to "Set fair" or to "Changeable," and we look on the barometer as a thing that prophesies the kind of weather that we are going to have. As a matter of fact, however, it does nothing but measure the atmo-

MEASURING A MOUNTAIN WITH AIR



The height of a mountain can be measured with a barometer. In the left picture we see a barometer on a mountain two miles high. The pressure of the atmosphere on the cistern, X, causes the mercury to rise in the tube, V. Down in the valley, the greater weight of the air on the cistern makes the mercury rise higher in the tube, and by comparing the two readings of the barometer the height of the mountain is calculated.

spheric pressure at the place and time in question. The pointer is so made as to indicate the height in inches of the column of mercury which the atmosphere will hold up, then and there.

WHY A BAROMETER TELLS US WHAT THE WEATHER WILL BE

The relation of the barometer to the weather lies in the fact that, on the whole, the most important thing in deciding the weather is the atmospheric pressure. If the atmospheric pressure is very high at a place, there will be no disturbance there; but if it is very low, then air will be rushing towards that place from other places where the pressure is higher. That means wind, and wind may mean rain. So we see where the connection between the barometer and the weather comes in; and when we find, as we sometimes do, that the barometer cannot quite be trusted as a weather-glass, we must remember that the causes of the weather are very complicated, and that the atmospheric pressure, though the most important of them, is only one of them. We have a way of giving things names according to the use to which we put them, and so we may call the mercurial barometer a weather-glass, but that is certainly not its proper name.

For the matter of that we might call it a mountain measurer; for, as we can now quite readily understand, this simple instrument actually gives us a way of discovering how high a mountain is. All we have to do is to find out how much the mercury in it falls for every thousand feet that we go up, and then we can reckon how high a mountain is. There is, however, one serious condition attached to this method, which is—first climb your mountain! That is often impossible; and in any case there are more accurate ways of measuring the heights of mountains than with a barometer.

HOW THE MERCURY IN THE TUBE MOVES THE POINTER OF THE BAROMETER

The ordinary barometer that we see everywhere is really just Torricelli's instrument; but the end of the tube is usually turned up so as to make it U-shaped, instead of having the tube straight and the end of it in a vessel of mercury. If we float an iron ball on the top of the mercury, where the tube is open, we can easily attach to the ball some arrangement with a pointer which can tell us what the height of the mercury is in the tube, or it can be made to point to words like fair or rain.

There is another kind of barometer which has no mercury or any other liquid in it, and which is called an aneroid barometer. This literally means the barometer that has no fluid in it. It is simply a round, flat, metal box which has been emptied of air as far as possible. The top and the bottom of the box are pressed towards each other by the atmosphere more or less, according to whether the atmospheric pressure is high or low, and it is not difficult to make arrangements by which we can easily read off the extent to which the box is being pressed. The results attained by this instrument are not at all precise, but it is quite useful to have in the house as a weather-glass.

If we took an ordinary mercury barometer and made it warm, the mercury would expand, and take up more space in the tube, as most things do when they are warmed. Therefore, if we want our results to be precise, we should always be able to allow for the temperature when using a barometer.

THE AIR PRESSES UPON US EQUALLY IN ALL DIRECTIONS

So a good barometer always has a thermometer, or heat measurer, with it. In making a barometer, we should first boil the mercury, so as to get out of it all the air and water-vapor that we can. If we omit to do this, of course the air and water-vapor will pass out of the mercury, when we have made our barometer, into the Torricellian vacuum at the top of the tube, and they will prevent the mercury from rising as high as it ought to do.

If we take our reckoning at the sea level, as we generally do, we find that the pressure of the atmosphere is equal to the pressure of rather more than fourteen pounds on every square inch of surface. Our own bodies are, of course, exposed on every square inch of their surface to this great pressure; and if the pressure were wholly a downward one, weighing upon our heads, we could not stand it. But a great law about fluid pressure is that at any place it is the same in all directions. Therefore, though we are pressed down upon, we are also pressed in upon from the side, and thus we are equally supported from all directions, and the atmospheric pressure does us no harm. If it should happen that at any part of our bodies we were not equally pressed upon, we should soon notice a rather startling result. If we take a little glass tube, and burn something in it, so that it becomes filled with hot air, and then quickly press the mouth of it against the skin, it is interesting to see what follows. The air inside the tube is very hot, and air, we know, like most things, stretches, or expands, when it is hot. But in a little while the air becomes cooled, and as it cools it shrinks. This means that the pressure inside the tube is lower than outside it. Another way of putting this is that the pressure on the piece of skin covered by the tube is less than the general atmospheric pressure upon the rest of the body.

The laws of force are bound to have their way; the pressure upon the skin outside the tube squeezes some of the fluids of the body up into the tube, and the skin inside the tube—which is not being pressed upon as the rest of the skin is—is forced up into the tube by the pressure of the fluid underneath it, sometimes quite a long distance, forming a sort of little finger of skin.

A BOY'S GAME THAT PROVES A SCIENTIFIC LAW

If a student has nothing better to do, and puts three or four such tubes on his forehead, and walks about with them sticking there, he looks very absurd indeed, but he teaches those who see him that the pressure of the atmosphere upon the surface of our bodies is a very real thing.

The game that boys play with a sucker and a stone also depends on the atmospheric pressure. We know that a piece of soft leather, when moistened, will catch on to a stone and lift it up; but, of course, the instant the corner of the leather is raised, and the air is allowed to rush in, the stone will drop. If boys could live on the moon they certainly could not play this game there, because the moon has practically no atmosphere.

We have already learned that it is the atmospheric pressure by which we breathe. Sometimes, however, instead of wishing to draw air into our lungs, we wish to draw water into our mouths. Take the case of sucking lemonade through a straw, or of filling a syringe with ink for a fountain-pen. It is the atmospheric pressure that we use in these cases, too. When we suck through the straw, all we do is to lower the pressure at the end of the straw that is in our mouths, and then the pressure upon the surface of the fluid in the tumbler pushes some of it up the straw.

WHY THE WATER COMES OUT OF THE PUMP

If we keep the tip of our tongue over the end of the straw, we can hold the column of fluid in the straw in spite of the attraction of gravity. But when we take our tongue away and allow the pressure at both ends of the straw to be equal, gravity has no force to oppose it, and the column of fluid falls.

Such use of a straw is just the same as the way in which a syringe is filled; and an ordinary pump is just the same as a syringe. Inside the pump there is a thing called a piston which fits it closely, and when the piston is raised, it lowers the pressure inside the pump, and liquid is sucked up—that is to say, pushed into the pump from outside by the atmospheric pressure. It is a mere detail whether, when we have got the liquid into the thing, we send it out by the way it came, as we do in a garden syringe, or whether we provide another opening for it somewhere else, as we do in a pump.

We all know those bottles that are often called siphons, which are so made that the liquid in them will run up a long tube and then down another. Properly, we should simply call the tube itself a siphon. If we take such a bent tube quite apart from the bottle, and fill it with water, and then put one end of it in a tumbler of water, as the picture upon page 733 shows, the water will all run out at the other end.

WHY A SIPHON WILL EMPTY A GLASS OF WATER

Atmospheric pressure acts on both ends of the siphon equally, so as to keep that part of the tube which rises above the level of the water in the tumbler full of water. The force of gravity now pulls on the water in the two arms of the siphon. The water in the longer arm being heavier causes a movement in the direction of the longer arm. As water escapes from the end of the longer arm, more water takes its place from the tumbler. This goes on until the tumbler is emptied. The flow would stop if the water in the two arms of the siphon became the same in height.

The atmospheric pressure is the most important, and perhaps the easiest to understand, of all kinds of fluid pressure. When we go more closely into the laws of fluids, we find them exceedingly difficult, yet one or two of the great results are easy to understand. The law that the pressure of a fluid at any point is equal in all directions has already been mentioned. If, however, we are to state this law quite correctly, we must add one more word. We must say not "a fluid," but "a motionless fluid." Of course, directly we introduce a new thing—which is the motion of the fluid—then the whole case is changed. For instance, we do not feel the atmospheric pressure to any noticeable extent, but we *do* feel the wind.

AN EXTRAORDINARY MAN WHO DISCOVERED THE LAW OF EQUAL PRESSURE

This law of the equality of fluid pressure in all directions stands to the credit of that extraordinary Frenchman Pascal, whom we have already mentioned. He is to be called extraordinary because his mind was so complete. People who study religion and duty and good and evil have to read the works of Pascal, because he thought so wisely and deeply on those subjects; people who study pure mathematics have to make acquaintance with Pascal; and people who study what happens in a tumbler of water have to study Pascal, too. In the whole history of mankind there are only a very few cases like this.

Now, it is interesting to invent an experiment to prove the truth of Pascal's law. If we take an empty bottle and cork it, and push it down into deep water, or rather sink it by attaching a weight to it, the fluid pressure will force the cork into the bottle. Now, we find that it does not matter whether the bottle is right side up or upside down, or placed at any angle, the result is just the same. Therefore, to take the case of a fish swimming in the water, it is subjected to a pressure which is upwards as well as downwards and sideways. The point is that the fluid has no greater tendency to press anything in one direction more than in another. Here we find the great difference between fluid pressure and the pressure of this book on the table, or the table on the floor, or the beams of the roof against the walls of the house. The pressure exerted by one solid thing on another is in one direction only.

GASES THAT CAN BE SQUEEZED AND LIQUIDS THAT CANNOT

The great laws of fluid pressure are the same for both kinds of fluids; but it is very plain to everyone that, however true this may be, there must be some very great difference between the kind of fluid we call a gas and the kind we call a liquid. If we take any gas, or mixture of gases, and squeeze it, we find that it can be squeezed. When we cease to apply the force by which we squeeze it, then it expands again. The proper way of saying this is that a gas is compressible; but the other kind of fluid, which we call a liquid—as, for instance, water—is, practically, not compressible.

It has been proved comparatively recently that it is possible, with very great pressure indeed, to compress water a very little. We should understand this; but still there remains the great difference that a gas is readily compressible, and that a liquid is for all practical purposes quite incompressible. Now, as gases can be compressed by pressure, we ought to know whether there is any law governing the results. There is such a law, and that is the last thing we need learn in this part of our subject.

THE DISCOVERY OF ROBERT BOYLE WHICH EXPLAINS A GAS EXPLOSION

It was discovered by, and is named after, a celebrated Englishman named Robert Boyle, who lived in the seventeenth century. Boyle's law says that if the temperature of a gas remains the same, the greater its pressure the less space it fills. If this pressure is to rise, the volume must fall; and if the pressure is to fall, the volume must rise. This means that a certain proportion of gas will exert more pressure in proportion as it occupies a smaller space. We realize this when we cause a great explosion, by suddenly making a lot of gas in a very little space.

THE NEXT PART OF THIS IS ON PAGE 4083.

A POEM OF SORROW, FAITH, AND HOPE

As printed among the poet's works, this is a long poem of one hundred and thirty-one sections, with a prologue and an epilogue. It is really a collection of short poems written on different occasions over a period of some sixteen years. As stated on page 2191, the whole is dedicated to the memory of a dear friend of the poet, Arthur Henry Hallam, who was expected, by all who knew him, to become one of the most notable men of England, but died suddenly at Vienna on September 15, 1833, and was brought back by sea and buried at Clevedon, on the Bristol Channel, January 3, 1834. Tennyson's grief at the loss of his friend was so intense that, for many years, the death of Hallam had a constant influence on the poet's life, turning his thoughts to the contemplation of man's destiny, and the effect of grief in purifying the mind of man. The sections are numbered in order here, but the numbers are not, of course, the same as those in the whole poem.

TENNYSON'S "IN MEMORIAM"

CONTINUED FROM 3872

STRONG Son of God, immortal Love,
Whom we, that have not seen Thy face,
By faith, and faith alone, embrace,
Believing where we cannot prove;

Thine are these orbs of light and shade;
Thou madest Life in man and brute;
Thou madest Death; and lo, Thy foot
Is on the skull which Thou hast made.

Thou wilt not leave us in the dust:
Thou madest man, he knows not why,
He thinks he was not made to die;
And Thou hast made him: Thou art just.

II.

IN GRIEF'S FIRST HOUR

Tennyson's great poem begins as above, striking at once a note of confident hope in the goodness and mercy of God. Overshadowed by the loss of his dear friend, he naturally asks himself whether he and his friend will live again, and continue in another life the friendship of this. He has been studying works of philosophy concerning the origin of the world and man, but from them he only comes to know that we cannot understand the inner mysteries of the world and life, and must be content with simple faith in God's mercy. But despite his faith, he finds himself wandering sorrowfully in the street where his beloved friend had lived.

Dark house, by which once more I stand
Here in the long unlovely street,
Doors, where my heart was used to beat
So quickly, waiting for a hand,

A hand that can be clasp'd no more—
Behold me, for I cannot sleep,
And like a guilty thing I creep
At earliest morning to the door.

He is not here; but far away
The noise of life begins again,
And ghastly thro' the drizzling rain
On the bald street breaks the blank day.

III.

THE LAST JOURNEY OF THE DEAD

"Every pleasant spot" where the friends had been in the habit of meeting now seems dark to him, and blank despair has for the moment driven hope and faith away. The poet's soul has now begun to feel with a new keenness in his grief, but his thoughts are again sweet and gentle when he contemplates the last journey of his dead friend over seas to the quiet resting place by the waters of the Severn.

Fair ship, that from the Italian shore
Sailest the placid ocean-plains
With my lost Arthur's loved remains,
Spread thy full wings, and waft him o'er.

So draw him home to those that mourn
In vain: a favourable speed
Ruffle thy mirror'd mast, and lead
Thro' prosperous floods his holy urn.

I hear the noise about thy keel;
I hear the bell struck in the night:
I see the cabin window bright;
I see the sailor at the wheel.

Thou bring'st the sailor to his wife,
And travell'd men from foreign lands;
And letters unto trembling hands;
And, thy dark freight, a vanish'd life.

So bring him: we have idle dreams:
This look of quiet flatters thus
Our home-bred fancies: O to us,
The fools of habit, sweeter seems

To rest beneath the clover sod,
That takes the sunshine and the rains,
Or where the kneeling hamlet drains
The chalice of the grapes of God;

Than if with thee the roaring wells
Should gulf him fathom-deep in brine;
And hand so often clasp'd in mine
Should toss with tangle and with shells.

IV.

IF THE LOST CAME BACK

"Is this the end of all my care?" the poet asks himself when the body of his friend has been hidden in the dark grave. In the depth of his grief his reason is not calm enough to answer him and he can only resign himself to his sorrow and to what time may teach him. In these verses he expresses the commonest feelings of humankind: the difficulty at first of believing that a dear friend, who has just died, will never meet us and speak to us again in this world.

If one should bring me this report,
That thou hadst touch'd the land today,
And I went down unto the quay,
And found thee lying in the port;

And standing, muffled round with woe,
Should see thy passengers in rank
Come stepping lightly down the plank,
And beckoning unto those they know;

And if along with these should come
  The man I held as half divine;
  Should strike a sudden hand in mine,
And ask a thousand things of home;

And I should tell him all my pain,
  And how my life had droop'd of late,
  And he should sorrow o'er my state,
And marvel what possess'd my brain;

And I perceived no touch of change,
  No hint of death in all his frame,
  But found him all in all the same,
I should not feel it to be strange.

V.

NATURE'S SOOTHING INFLUENCE

"Calm despair and wild unrest" are now the two opposing feelings struggling within him, but when he comes again to the grave of his friend, the very gentleness of the natural scenes has a soothing influence on his spirit, and he writes:

The Danube to the Severn gave
  The darken'd heart that beats no more;
  They laid him by the pleasant shore,
And in the hearing of the wave.

There twice a day the Severn fills;
  The salt sea-water passes by,
  And hushes half the babbling Wye,
And makes a silence in the hills.

The Wye is hush'd nor moved along,
  And hush'd my deepest grief of all,
  When fill'd with tears that cannot fall,
I brim with sorrow drowning song.

The tide flows down, the wave again
  Is vocal in its wooded walls;
  My deeper anguish also falls,
And I can speak a little then.

VI.

MEMORIES OF THE LOST FRIEND

His grief is still a purely personal emotion, and has not yet led him into the wider and deeper feelings which we call "universal," because they embrace mankind as a whole. It is still of their old remembered companionship he sings.

The path by which we twain did go,
  Which led by tracts that pleased us well,
  Thro' four sweet years arose and fell,
From flower to flower, from snow to snow:

And we with singing cheer'd the way,
  And, crown'd with all the season lent,
  From April on to April went,
And glad at heart from May to May:

But where the path we walk'd began
  To slant the fifth autumnal slope,
  As we descended following Hope,
There sat the Shadow fear'd of man;

Who broke our fair companionship,
  And spread his mantle dark and cold,
  And wrapt thee formless in the fold,
And dull'd the murmur on thy lip,

And bore thee where I could not see
  Nor follow, tho' I walk in haste;
  And think that, somewhere in the waste,
The shadow sits and waits for me.

VII.

THE SACRIFICE OF LOVE

But in the presence of this "Shadow cloaked from head to foot," which is, of course, Death, "who keeps the keys of all the creeds," the poet begins to ponder over the great mysteries of man's life and destiny. His thoughts of life, however, are always involved with memories of his friend.

I know that this was Life—the track
  Whereon with equal feet we fared;
  And then, as now, the day prepared
The daily burden for the back.

But this it was that made me move
  As light as carrier-birds in air;
  I loved the weight I had to bear,
Because it needed help of Love:

Nor could I weary, heart or limb,
  When mighty Love would cleave in twain
  The lading of a single pain,
And part it, giving half to him.

VIII.

THE LESSONS OF LIFE

From his personal feelings he now begins to draw the real lessons of life, and as the wildness of despair gives place at length to more reasonable and calmer thoughts, he is able to contemplate his loss with calmness and resignation.

I envy not in any moods
  The captive void of noble rage,
  The linnet born within the cage,
That never knew the summer's woods.

I envy not the beast that takes
  His license in the field of time,
  Unfetter'd by the sense of crime,
To whom a conscience never wakes;

Nor, what may count itself as blest,
  The heart that never plighted troth,
  But stagnates in the weeds of sloth;
Nor any want-begotten rest.

I hold it true, whate'er befall,
  I feel it, when I sorrow most,
  'Tis better to have loved and lost
Than never to have loved at all.

IX.

THE MESSAGE OF THE BELLS

Then, with the approach of Christmastide, and all its holy memories, he finds his very sorrow touched with joy. New feelings of hope, and a serene happiness born of his rising faith in God's mercy, now dwell in that breast where so recently the wildness of sorrow and despair had reigned.

The time draws near the birth of Christ;
  The moon is hid, the night is still,
  The Christmas bells from hill to hill
Answer each other in the mist.

Four voices of four hamlets round,
  From far and near, on mead and moor,
  Swell out and fail, as if a door
Were shut between me and the sound:

Each voice four changes on the wind
  That now dilate, and now decrease,
  Peace and goodwill, goodwill and peace,
Peace and goodwill, to all mankind.

This year I slept and woke with pain,
  I almost wish'd no more to wake,
  And that my hold on life would break
Before I heard those bells again;

But they my troubled spirit rule,
For they controlled me when a boy;
They bring me sorrow touch'd with joy,
The merry, merry bells of Yule.

X.

THE POET'S FAITH AND DOUBT

His faith in the promises of God, as revealed to us in the teachings of Jesus, is not yet absolute, and his mind is not without its doubts, but he has emerged from his darkest sorrow with the conviction that the grave is not the end of all.

My own dim life should teach me this,
That life shall live for evermore,
Else death is darkness at the core,
And dust and ashes all that is;

This round of green, this orb of flame,
Fantastic beauty; such as lurks
In some wild Poet, when he works
Without a conscience or an aim.

What then were God to such as I?
'Twere hardly worth my while to choose
Of things all mortal, or to use
A little patience ere I die.

'Twere best at once to sink to peace,
Like birds the charming serpent draws,
To drop head-foremost in the jaws
Of vacant darkness and to cease.

XI.

DO THE DEPARTED THINK OF US?

It is springtime again, and the poet still is singing his mournful songs in memory of his friend. For the first time we find him wondering whether the spirit of the departed takes any interest in the life on earth, and, if so, he cannot but think these songs of his will be grateful to the spirit's ear.

With weary steps I loiter on,
Tho' always under alter'd skies,
The purple from the distance dies,
My prospect and horizon gone.

No joy the blowing season gives,
The herald melodies of spring,
But in the songs I love to sing
A doubtful gleam of solace lives.

If any care for what is here
Survive in spirits render'd free,
Then are these songs I sing of thee
Not all ungrateful to thine ear.

XII.

THE PURPOSE OF ALL LIFE

From this thought he goes on to speculate upon the life of the departed. "How fares it with the happy dead?" he asks and suggests that theirs is indeed the larger life, to which all the joys and sorrows and good and evil of this world we live in are but the dim and bungling preparations.

Oh, yet we trust that somehow good
Will be the final goal of ill,
To pangs of nature, sins of will,
Defects of doubt, and taints of blood;

That nothing walks with aimless feet;
That not one life shall be destroyed,
Or cast as rubbish to the void,
When God hath made the pile complete;

That not a worm is cloven in vain;
That not a moth with vain desire
Is shrivell'd in a fruitless fire,
Or but subserves another's gain.

And moving up from high to higher,
Becomes on Fortune's crowning slope
The pillar of a people's hope,
The centre of a world's desire;

Yet feels, as in a pensive dream,
When all his active powers are still:
A distant dearness in the hill,
A secret sweetness in the stream.

The limit of his narrower fate,
While yet beside its vocal springs
He play'd at counsellors and kings
With one that was his earliest mate;

Who ploughs with pain his native lea
And reaps the labour of his hands,
Or in the furrow musing stands;
"Does my old friend remember me?"

XIII.

WHEN GRIEF IS PAST

This, then, is the wide and universal hope that has grown within the soul of the poet, as he has turned from his own personal sorrows to contemplate the sorrows of all mankind, and to look with clearer faith upon the work of God. He has no longer any doubt that God has created man not as the mere creature of a passing day, but as an inheritor of immortal life. He begins also to feel half ashamed of his grief, saying that "The song of woe is, after all, an earthly song," and in the larger love of mankind, which Jesus came to teach, he finds the joy that far outweighs the loss of a friend. Another year has passed; it is Christmas once more.

Again at Christmas did we weave
The holly round the Christmas hearth;
The silent snow possess'd the earth,
And calmly fell our Christmas-eve.

The Yule-log sparkled keen with frost,
No wing of wind the region swept,
But over all things brooding slept
The quiet sense of something lost.

As in the winters left behind,
Again our ancient games had place,
The mimic picture's breathing grace,
And dance and song and hoodman-blind.

Who showed a token of distress?
No single tear, no mark of pain:
O sorrow, then can sorrow wane?
O grief, can grief be changed to less?

O last regret, regret can die!
No—mixt with all this mystic frame,
Her deep relations are the same,
But with long use her tears are dry.

XIV.

THOUGHTS AT THE COMING OF SPRING

The poet is thus uneasy at the thought that his sorrow for his friend has lessened. It is personal feeling again pushing against the wider love of humanity, and in the following beautiful song of spring he calls upon the warmer season of the year to thaw his frozen sorrow and let it flower again.

Dip down upon the northern shore,
O sweet new year delaying long;
Thou doest expectant Nature wrong,
Delaying long; delay no more.

What stays thee from the clouded noons,
Thy sweetness from its proper place?
Can trouble live with April days,
Or sadness in the summer moons?

Bring orchid, bring the foxglove spire,
The little speedwell's darling blue,
Deep tulips dash'd with fiery dew,
Laburnums, drooping-wells of fire.

O thou, new year, delaying long,
Delayest the sorrow in my blood,
That longs to burst a frozen bud
And flood a fresher throat with song.

XV.

WHAT MIGHT HAVE BEEN

His mind is back again entirely with his friend, when he sings thus of what might have been had the lost one lived to marry the poet's sister, to whom he had been engaged.

When I contemplate all alone
The life that had been thine below,
And fix my thoughts on all the glow
To which thy crescent would have grown,

I see thee sitting crown'd with good,
A central warmth diffusing bliss
In glance and smile, and clasp and kiss,
On all the branches of thy blood;

Thy blood, my friend, and partly mine;
For now the day was drawing on,
When thou shouldst link thy life with one
Of mine own house, and boys of thine

Had babbled "Uncle" on my knee;
But that remorseless iron hour
Made cypress of her orange flower,
Despair of Hope, and earth of thee.

I seem to meet their least desire,
To clap their cheeks, to call them mine.
I see their unborn faces shine
Beside the never-lighted fire.

I see myself an honour'd guest,
Thy partner in the flowery walk
Of letters, genial table-talk,
Or deep dispute, and graceful jest;

While now thy prosperous labour fills
The lips of men with honest praise,
And sun by sun the happy days
Descend below the golden hills

With promise of a morn as fair;
And all the train of bounteous hours
Conduct by paths of growing powers
To reverence and the silver hair;

Till slowly worn her earthly robe,
Her lavish mission richly wrought,
Leaving great legacies of thought,
Thy spirit should fail from off the globe.

What time mine own might also flee,
As link'd with thine in love and fate,
And, hovering o'er the dolorous strait
To the other shores involved in thee;

Arrive at last the blessed goal,
And He that died in Holy Land
Would reach us out the shining hand,
And take us as a single soul.

What reed was that on which I leant?
Ah, backward fancy, wherefore wake
The old bitterness again, and break
The low beginnings of content.

XVI.

FAMILIAR SCENES REVISITED

For a time the thoughts of the poet are again entirely with the departed; then comes a visit to Cambridge, where they had been at college together, but the sense of personal loss is no longer felt, the gloom has lifted from the poet's mind.

I passed beside the reverend walls
In which of old I wore the gown;
I roved at random thro' the town,
And saw the tumult of the halls;

And heard once more in college fanes
The storm their high-built organs make,
And thunder-music, rolling, shake
The prophets blazon'd on the panes:

And caught once more the distant shout.
The measured pulse of racing oars
Among the willows; paced the shores
And many a bridge, and all about

The same grey flats again, and felt
The same, but not the same; and last
Up that long walk of limes I passed
To see the rooms in which he dwelt.

Another name was on the door:
I linger'd; all within was noise
Of songs, and clapping hands, and boys
That crash'd the glass, and beat the floor;

Where once we held debate, a band
Of youthful friends, on mind and art
And labour, and the changing mart,
And all the framework of the land;

When one would aim an arrow fair,
But send it slackly from the string;
And one would pierce an outer ring,
And one an inner, here and there;

And last the master-bowman, he,
Would cleave the mark. A willing ear
We lent him. Who, but hung to hear
The rapt oration flowing free.

From point to point, with power and grace
And music in the bounds of law,
To those conclusions when we saw
The God within him light his face,

And seem to lift the form, and glow
In azure orbits heavenly-wise;
And over those ethereal eyes
The bar of Michael Angelo.

XVII.

THE MINGLING OF JOY AND REGRET

Through many sections of the poem the writer recalls events in his friendship with his lost companion, but there is always a feeling of joy now in his expressions of grief, no wavering note of doubt when he sings of the greater things of life and immortality. Another Christmas finds him calm of mind and strong in faith, as when he sings "Ring out, wild bells, to the wild sky," and ends that song—see page 2101—with the joyous note "Ring in the Christ that is to be."

Now fades the last long streak of snow,
Now burgeons every maze of quick
About the flowering squares, and thick
By ashen roots the violets blow.

Now rings the woodland loud and long,
The distance takes a lovelier hue,
And drown'd in yonder living blue
The lark becomes a sightless song.

Now dance the lights on lawn and lea,
The flocks are whiter down the vale,
And milkier every milky sail
On winding stream or distant sea;

Where now the seamew pipes, or dives
In yonder greening gleam, and fly
The happy birds, that change their sky
To build and brood; that live their lives

From land to land; and in my breast
Spring wakens too; and my regret
Becomes an April violet,
And buds and blossoms like the rest.

XVIII.

WHAT TIME HAS TAUGHT THE POET

So at last the poet's personal grief has passed away; "lived down," as we say. Time has indeed taught him wisdom, and he is wise in the confident hope that far better than unavailing sorrow for the dead is the steady faith in the reunion of friends in after life, "some strong bond which is to be."

Is it, then, regret for buried time
That keenlier in sweet April wakes,
And meets the year, and gives and takes
The colours of the crescent prime?

Not all: the songs, the stirring air,
The life re-orient out of dust,
Cry thro' the sense to hearten trust
In that which made the world so fair.

Not all regret: the face will shine
Upon me, while I muse alone;
And that dear voice, I once have known,
Still speak to me of me and mine.

Yet less of sorrow lives in me
For days of happy commune dead;
Less yearning for the friendship fled,
Than some strong bond which is to be.

XIX.

THE END OF MAN

The last thoughts of the poet, freed from all contemplation of his own feelings, are with mankind as a whole, and in his vision he sees the ultimate triumph of life over death, of good over evil. Man is no mere animal, but capable of love and sufferings and hope, and these are but the seeds of what will flower and bear fruit in the after life of the soul.

Whereof the man, that with me trod
This planet, was a noble type
Appearing ere the times were ripe,
That friend of mine who lives in God,

That God, which ever lives and loves,
One God, one law, one element,
And one far-off divine event,
To which the whole creation moves.

THE FLIGHT OF PETER BELL

The lines which we give here are merely the introductory verses to a long poem by William Wordsworth, entitled "Peter Bell: A Tale." The whole is a fanciful and not unprofitable story, but the imagination of the poet is seen in its most attractive guise in these introductory verses, which form of themselves a complete little poem.

THERE'S something in a flying horse,
There's something in a huge balloon;
But through the clouds I'll never float
Until I have a little Boat
Shaped like the crescent-moon.

And now I have a little Boat,
In shape a very crescent-moon;
Fast through the clouds my Boat can sail;
But if perchance your faith should fail,
Look up—and you shall see me soon!

The woods, my Friends, are round you roaring,
Rocking and roaring like a sea;
The noise of danger's in your ears,
And ye have all a thousand fears
Both for my little Boat and me!

Meanwhile untroubled I admire
The pointed horns of my canoe;
And did not pity touch my breast,
To see how ye are all distrest,
Till my ribs ached, I'd laugh at you!

Away we go, my Boat and I—
Frail man ne'er sate in such another;
Whether among the winds we strive,
Or deep into the clouds we dive,
Each is contented with the other.

Away we go—and what care we
For reason, tumults, and for wars?
We are as calm in our delight
As is the crescent-moon so bright
Among the scattered stars.

Up goes my Boat among the stars
Through many a breathless field of light,
Through many a long blue field of ether,
Leaving ten thousand stars beneath her:
Up goes my little Boat so bright.

The Crab, the Scorpion, and the Bull—
We pry among them all; have shot
High o'er the red-haired race of Mars,
Covered from top to toe with scars;
Such company I like it not.

The towns in Saturn are decayed,
And melancholy Sceptres throng them—
The Pleiads, that appear to kiss
Each other in the vast abyss,
With joy I sail among them.

Swift Mercury resounds with mirth,
Great Jove is full of stately bowers;
But these, and all that they contain,
What are they to that tiny grain—
That little Earth of ours?

Then back to Earth, the dear green Earth—
Whole ages if I here should roam,
The worlds for my remarks and me,
Would not a whit the better be;
I've left my heart at home.

See! there she is, the matchless Earth!
There spreads the famous Pacific Ocean!
Old Andes thrusts yon craggy spear
Through the grey clouds; the Alps are here,
Like waters in commotion.

Yon tawny slip is Libya's sands,
That silver thread the river Dnieper;
And look, where clothed in brightest green
Is a sweet isle, of isle the Queen;
Ye fairies, from all evil keep her.

And see the town where I was born!
Around those happy fields we span
In boyish gambols; I was lost
Where I have been, but on this coast
I feel I am a man.

Never did fifty things at once
Appear so lovely, never, never
How tunefully the forests ring!
To hear the earth's soft murmuring
Thus could I hang for ever.

ARMAGEDDON

Armageddon is the name given to the place whereon it is said that God will one day gather all His enemies and destroy them for ever. The idea of such a poetic ending to the forces of evil that prevail in the world is often used by writers, and in this fine poem by Sir Edwin Arnold, who was born June 10, 1822, and died in 1904, it is made the theme of a stirring "war poem of the future;" the eventual great battle in which the right will prevail. The poem is given here by permission of Messrs. Kegan, Paul & Co.

MARCHING down to Armageddon—
Brothers, stout and strong!
Let us cheer the way we tread on
With a soldier's song!
Faint we by the weary road,
Or fall we in the rout,
Dirge or Pæan, Death or Triumph!
Let the song ring out!
We are they who scorn the scorners—
Love the lovers—hate
None within the world's four corners—
All must share one fate;
We are they whose common banner
Bears no badge or sign,
Save the light which dyes it white—
The Hope that makes it shine.
We are they whose bugle rings,
That all the wars may cease;
We are they who pay the Kings
Their cruel price for Peace;
We are they whose steadfast watchword
Is what Christ did teach,
"Each man for his Brother first—
And Heaven, then, for each."
We are they who will not falter—
Many swords or few—
Till we make this earth the altar
Of a worship new;
We are they who will not take
From palace, priest, or code,
A meaner Law than "Brotherhood"—
A lower Lord than God.
Marching down to Armageddon—
Brothers, stout and strong!
Ask not why the way we tread on
Is so rough and long!
God will tell us when our spirits
Grow to grasp His plan!
Let us do our part to-day—
And help Him, helping Man!
Shall we even curse the madness,
Which for "ends of State"
Dooms us to the long, long sadness
Of this human hate?
Let us slay in perfect pity
Those that must not live;
Vanquish, and forgive our foes—
Or fall—and still forgive.
We are those whose unpaid legions,
In free ranks arrayed,
Massacred in many regions—
Never once were stayed;
We are those whose torn battalions,
Trained to bleed, not fly,
Make our agonies a triumph—
Conquer, while we die!
Therefore, down to Armageddon—
Brothers, bold and strong;
Cheer the glorious way we tread on
With this soldier's song!
Let the armies of the old Flags
March in silent dread!
Death and Life are one to us,
Who fight for Quick and Dead!

WHY THE ROBIN'S BREAST IS RED

It is curious to think that James Ryder Randall, the American poet who sang in praise of the Confederates in "Maryland, My Maryland," during the Civil War in this country, and wrote the famous song of the South, "There's Life in the Old Land Yet," was also a writer of tender religious verse. In the following little poem he uses a very old and beautiful legend about the robin redbreast for the purpose of teaching a very necessary lesson in religious life.

THE Saviour, bowed beneath His cross, climbed up the dreary hill,
And from the agonising wreath ran many a crimson rill;
The cruel Roman thrust Him on with unrelenting hand,
Till, staggering slowly 'mid the crowd, He fell upon the sand.

A little bird that warbled near, that memorable day,
Flitted around and strove to wrench one single thorn away.
The cruel spike impaled his breast, and thus, 'tis sweetly said,
The robin has his silver vest incarnadined with red.

Ah, Jesu! Jesu! Son of Man! My dolour and my sighs
Reveal the lesson taught by this winged Ishmael of the skies.
I, in the palace of delight or cavern of despair,
Have plucked no thorns from Thy dear brow, but planted thousands there!

MEMORY

Thomas Bailey Aldrich, a famous American poet, expresses in these lines a curious fact which most people have experienced, though it is not until we have grown up that we notice it. Some quite unimportant events in our lives will be remembered by us far better than we can ever remember dates which are supposed to be of the greatest importance. Perhaps Memory is wiser than we are in thus calling to our mind the things of which we had taken least account.

MY mind lets go a thousand things,
Like dates of wars and deaths of kings,
And yet recalls the very hour—
'Twas noon by yonder village tower,
And on the last blue moon in May—
The wind came briskly up this way,
Crisping the brook beside the road;
Then, pausing here, set down its load
Of pine-scents, and shook listlessly
Two petals from that wild-rose tree.

ROSE AND ROOT

John James Platt, the writer of this little fable in verse, was an American poet of some distinction, born in 1835. The moral of the tiny story is that the real reward of good work is not its being seen by others, but the knowledge which the worker possesses of doing the good work for its own sake.

THE rose aloft in sunny air,
Beloved alike by bird and bee,
Takes for the dark root little care,
That toils below it ceaselessly.

I put my question to the flower:
"Pride of the summer, garden queen,
Why livest thou thy little hour?"
And the rose answered: "I am seen."

I put the question to the root,
"I mine the earth, content," it said,
"A hidden miner underfoot:
I know a rose is overhead."

BIRDS*

Richard H. Stoddard, a well-known American poet, in these verses gives us a pretty little fancy. It is a happy thought to liken the fleeting visions of the poet's brain to the birds that flit past the open cage, and yet the poet, even in the following lines has "caged" very daintily one of these fleeting fancies.

BIRDS are singing round my window,
Tunes the sweetest ever heard;
And I hang my cage there daily,
But I never catch a bird.

So with thoughts my brain is peopled,
And they sing there all day long;
But they will not fold their pinions
In the little cage of Song!

THE ELIXIR

George Herbert is one of the finest religious poets who have written in the English language. He came of a noble family, being born at Montgomery Castle, Wales, on April 3, 1593. He died on March 3, 1633, and his life was written by Izaak Walton. This is a good example of his poetry, and it is given in the quaint spelling of his time. "The Elixir" was a supposed magic stone that changed base metal into gold.

TEACH me, my God and King,
In all things Thee to see;
And what I do in anything,
To do it as for Thee.

Not rudely, as a beast,
To runne into an action;
But still to make Thee prepossest,
And give it his perfection.

A man that looks on glasse,
On it may stay his eye;
Or, if he pleaseth, through it passe,
And then the heaven espie.

All may of Thee partake:
Nothing can be so mean,
Which with his tincture (for Thy sake)
Will not grow bright and clean.

A servant with this clause
Makes drudgerie divine:
Who sweeps a room, as for Thy laws,
Makes that and th' action fine.

This is the famous stone
That turneth all to gold;
For that which God doth touch and own
Cannot for lesse be told.

LONDON, 1802

This famous sonnet by William Wordsworth was composed in London, as the title indicates, at a period when the outlook for England was somewhat doubtful, as Napoleon was lording it over Europe. The poet was impressed by the need of some great voice, like that of Milton's, to inspire the nation with patriotic fervor; but, fortunately, though no great poet arose, circumstances forced the British people to a supreme effort, and not many years later Napoleon was a prisoner of the British in lonely St. Helena; for British heroism had won the decisive battle of Waterloo.

MILTON! thou shouldst be living at this hour;
England hath need of thee; she is a fen
Of stagnant waters: altar, sword, and pen,
Fireside, the heroic wealth of hall and bower,
Have forfeited their ancient English dower
Of inward happiness. We are selfish men;
Oh! raise us up, return to us again;
And give us manners, virtue, freedom, power.
Thy soul was like a Star, and dwelt apart;
Thou hadst a voice whose sound was like the sea:
Pure as the naked heavens—majestic, free—
So didst thou travel on life's common way,
In cheerful godliness; and yet thy heart
The lowliest duties on herself didst lay.

TO THE LORD GENERAL CROMWELL

In this great sonnet Milton addresses Oliver Cromwell before he has been declared Protector of the Commonwealth. The poet rejoices in the victories of the Puritan arms, but reminds the great soldier that in the time of peace that is coming there are other victories to be won, and the foes of religious freedom still to be fought.

CROMWELL, our chief of men, who through a cloud
Not of war only, but detractions rude,
Guided by faith and matchless fortitude,
To peace and truth thy glorious way hast ploughed,
And on the neck of crowned fortune proud
Hast reared God's trophies, and His work pursued,
While Darwen stream with blood of Scots imbrued
And Dunbar field resounds thy praises loud,
And Worcester's laureate wreath. Yet much remains
To conquer still; peace hath her victories
No less renowned than war: new foes arise
Threatening to bind our souls with secular chains;
Help us to save free conscience from the paw
Of hireling wolves, whose gospel is their maw.

ABIDE WITH ME

There are few hymns in our language more popular throughout the churches than this. An interesting story attaches to the writing of it. The author was a well-known minister and hymn-writer—see page 1801—named H. F. Lyte, and he wrote these verses in the evening of the Sunday on which he preached his last sermon. It is thus a very real expression of the human heart leaning in its last hours of life to the Creator. For "Abide with Me" is not, as many suppose, an evening hymn, but a hymn of closing life, as it was the dying song of him who wrote it.

ABIDE with me! fast falls the eventide,
The darkness deepens: Lord, with me abide!
When other helpers fail, and comforts flee,
Help of the helpless, oh, abide with me!

Swift to its close ebbs out life's little day;
Earth's joys grow dim; its glories pass away;
Change and decay in all around I see:
O Thou, who changest not, abide with me!

Not a brief glance I beg, a passing word:
But as Thou dwell'st with Thy disciples, Lord—
Familiar, condescending, patient, free—
Come, not to sojourn, but abide with me!

Come not in terrors, as the King of kings:
But kind and good, with healing in Thy wings;
Tears for all woes, a heart for every plea;
Come, Friend of sinners, and thus 'bide with me!

I need Thy presence every passing hour;
What but Thy grace can foil the tempter's power?
Who like Thyself my guide and stay can be?
Through cloud and sunshine, oh, abide with me!

I fear no foe, with Thee at hand to bless:
Ills have no weight, and tears no bitterness:
Where is Death's sting? Where, Grave, thy victory?
I triumph still, if Thou abide with me.

Hold then Thy cross before my closing eyes!
Shine through the gloom, and point me to the skies!
Heaven's morning breaks, and earth's vain shadows flee:
In life and death, O Lord, abide with me!

---

*From "Poems of Richard Henry Stoddard," copyright, 1880, by Charles Scribner's Sons.

INCIDENT OF THE FRENCH CAMP

In this poem Robert Browning relates a real event which happened in Napoleon's war with Austria, in 1809. The only difference between the poet's account of the incident and the actual episode is that the hero was a man and not a boy.

YOU know we French stormed Ratisbon,
A mile or so away;
On a little mound, Napoleon
Stood on our storming day;
With neck out-thrust, you fancy how,
Legs wide, arms locked behind,
As if to balance the prone brow
Oppressive with its mind.
Just as perhaps he mused "My plans
That soar to earth may fall,
Let once my army leader, Lannes,
Waver at yonder wall."
Out 'twixt the battery-smokes there flew
A rider, bound on bound
Full galloping; nor bridle drew
Until he reached the mound.
Then off there flung in smiling joy,
And held himself erect
By just his horse's mane, a boy;
You hardly could suspect—
So tight he kept his lips compressed,
Scarce any blood came through—
You looked twice ere you saw his breast
Was all but shot in two.
"Well," cried he, "Emperor, by God's grace
We've got you Ratisbon!
The Marshal's in the market-place,
And you'll be there anon
To see your flag-bird flap his vans
Where I, to heart's desire,
Perched him!" The chief's eye flashed; his plans
Soared up again like fire.
The chief's eye flashed; but presently
Softened itself, as sheathes
A film the mother-eagle's eye
When her bruised eaglet breathes;
"You're wounded!" "Nay," his soldier's pride
Touched to the quick, he said:
"I'm killed, Sire!" And his chief beside
Smiling the boy fell dead.

PEACE

Henry Vaughan was the name of a doctor who lived from 1622 to 1695 and wrote many poems of a religious character. This little poem of abiding faith in God is taken from his works.

MY soul, there is a country
Afar beyond the stars,
Where stands a winged sentry,
All skilful in the wars.
There, above noise and danger,
Sweet peace sits crowned with smiles,
And One born in a manger
Commands the beauteous files.
He is thy gracious Friend,
And (O my soul awake!)
Did in pure love descend,
To die here for thy sake.
If thou canst get but thither,
There grows the flower of peace—
The rose that cannot wither—
Thy fortress, and thy ease.
Leave, then, thy foolish ranges;
For none can thee secure,
But One who never changes—
Thy God, thy Life, thy Cure.

THE BUILDERS

Longfellow in this little poem seeks to remind us that in every action of our lives we are building the house of our future. That is to say, what we are doing well or ill to-day, and what we did ill or well yesterday, will mean much in the days to come. So it behooves us, as it does all good builders, to see that everything we do is of our best.

ALL are architects of fate;
Working in these walls of time:
Some with massive deeds and great,
Some with ornaments of rhyme.

Nothing useless is or low;
Each thing in its place is best;
And what seems but idle show
Strengthens and supports the rest.

For the structure that we raise
Time is with materials filled;
Our to-days and yesterdays
Are the blocks with which we build.

Truly shape and fashion these,
Leave no yawning gaps between;
Think not, because no man sees,
Such things will remain unseen.

JESUS BIDS US SHINE

The following has long been popular as a children's hymn, for which purpose its simple language makes it particularly suitable. The name of the writer is Emily H. Miller.

JESUS bids us shine
With a pure, clear light;
Like a little candle
Burning in the night,
In this world of darkness,
So we must shine—
You in your small corner,
And I in mine.

Jesus bids us shine,
First of all for Him;
Well He sees and knows it
If our light is dim.
He looks down from heaven
To see us shine—
You in your small corner,
And I in mine.

Jesus bids us shine,
Then, for all around;
Many kinds of darkness
In the world abound.
Sin and want and sorrow;
So we must shine—
You in your small corner,
And I in mine.

COMPOSED UPON WESTMINSTER BRIDGE

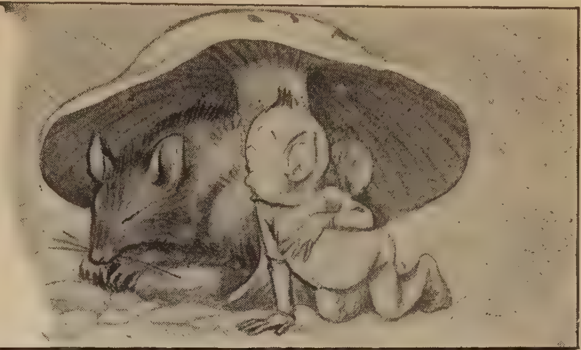
One of Wordsworth's finest sonnets, there are probably no lines about London more often quoted than these. It was one morning in the summer of 1802 that the poet, driving over Westminster Bridge on his way to Dover, was so struck with the grandeur of the scene, the great city still sleeping beneath the early sun, that the poem took shape in his mind, and he wrote the words as he traveled to Dover.

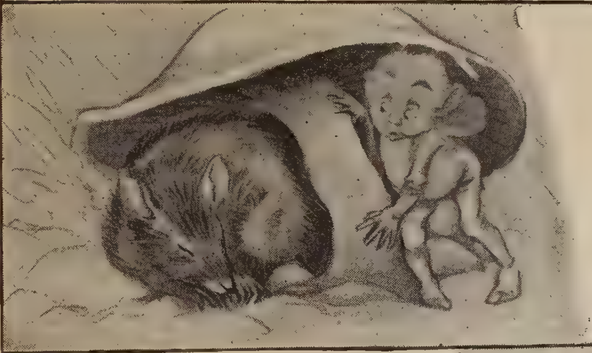
EARTH has not anything to show more fair:
Dull would he be of soul who could pass by
A sight so touching in its majesty:
This City now doth like a garment wear
The beauty of the morning: silent, bare,
Ships, towers, domes, theatres, and temples lie
Open unto the fields, and to the sky,
All bright and glittering in the smokeless air.
Never did sun more beautifully steep
In his first splendour valley, rock, or hill;
Ne'er saw I, never felt, a calm so deep!
The river glideth at his own sweet will:
Dear God! the very houses seem asleep;
And all that mighty heart is lying still!

LITTLE VERSES FOR VERY LITTLE PEOPLE

UNDER a toadstool
Crept a wee Elf,
Out of the rain,
To shelter himself.

Under the toadstool,
Sound asleep,
Sat a big Dormouse
All in a heap.



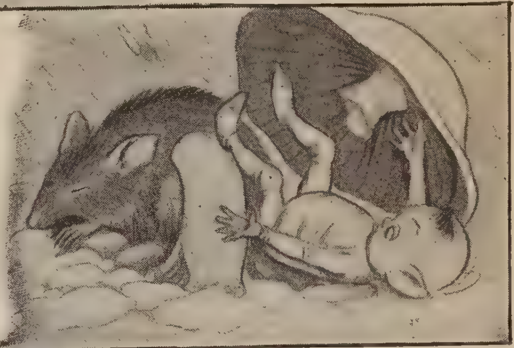


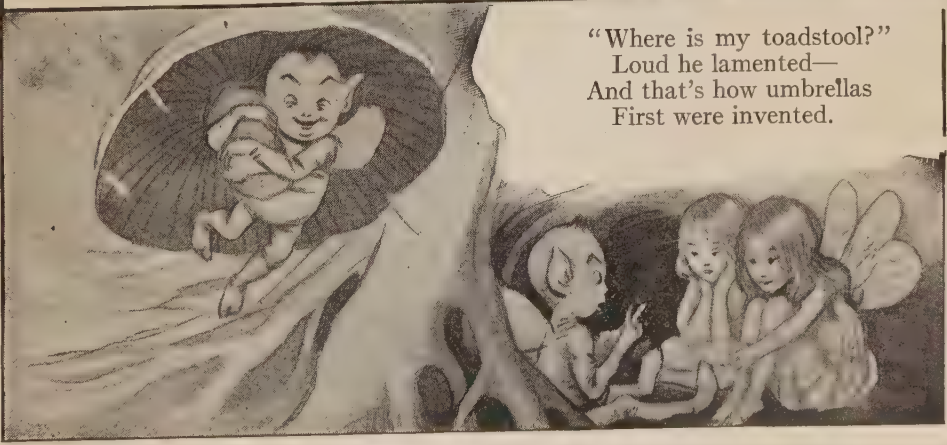
Trembled the wee Elf,
Frightened, and yet
Fearing to fly away
Lest he got wet.

To the next shelter—
Maybe a mile!
Sudden the wee Elf
Smiled a wee smile.

Tugged till the toadstool
Toppled in two.
Holding it over him,
Gaily he flew.

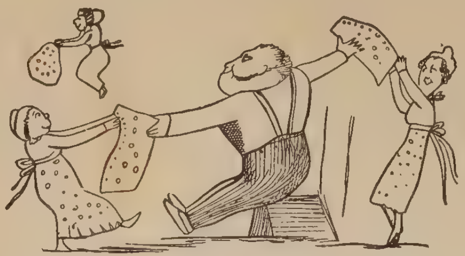
Soon he was safe home,
Dry as could be.
Soon woke the Dormouse—
"Good gracious me!



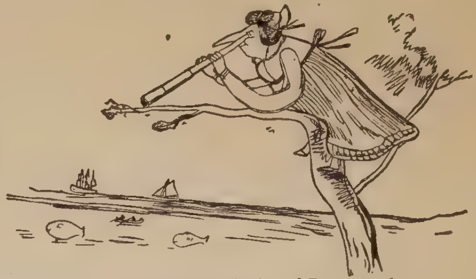


"Where is my toadstool?"
Loud he lamented—
And that's how umbrellas
First were invented.

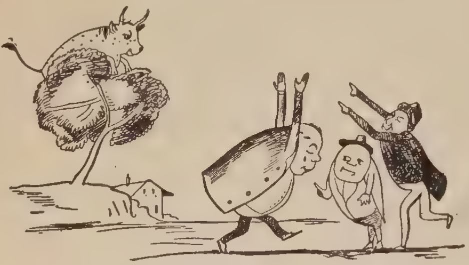
THE NONSENSE OF EDWARD LEAR



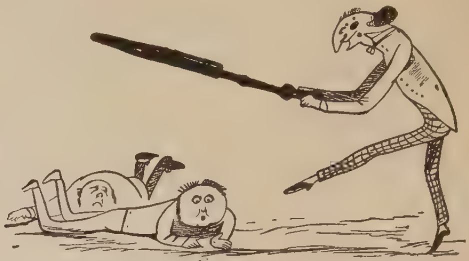
THERE was an old man in a pew,
Whose waistcoat was spotted with blue;
But he tore it in pieces,
To give to his nieces
That cheerful old man in a pew.



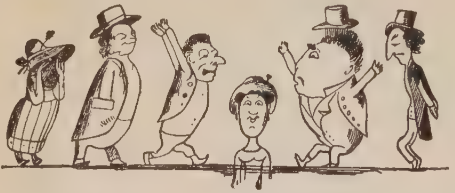
THERE was a young lady of Portugal,
Whose ideas were excessively nautical;
She climbed up a tree,
To examine the sea,
But declared she would never leave Portugal.



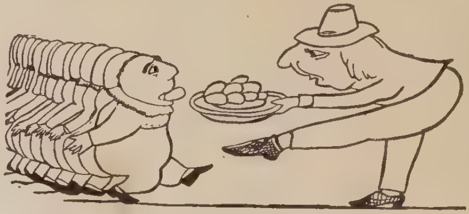
THERE was an old man of Aôsta,
Who possessed a large cow, but he lost her;
But they said, "Don't you see,
She has rushed up a tree?
You invidious old man of Aôsta!"



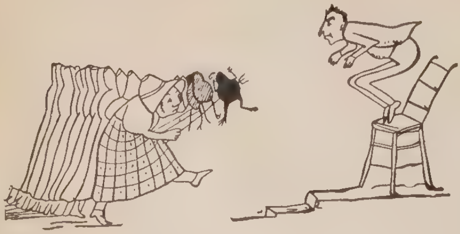
THERE was an old man with a poker,
Who painted his face with red oker;
When they said, "You're a guy!"
He made no reply,
But knocked them all down with his poker.



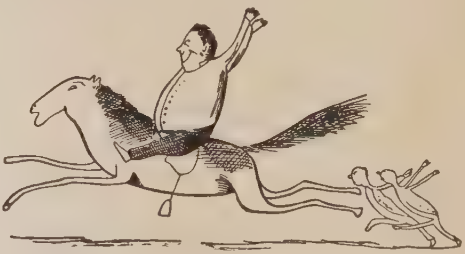
THERE was an old lady of Chertsey,
Who made a remarkable curtesy;
She twirled round and round,
Till she sunk underground,
Which distressed all the people of Chertsey.



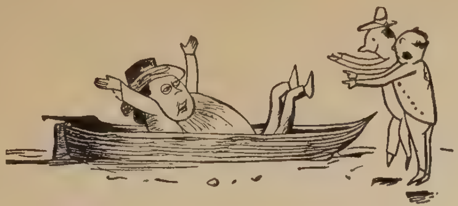
THERE was an old man of Apulia,
Whose conduct was very peculiar;
He fed twenty sons
Upon nothing but buns,
That whimsical man of Apulia.



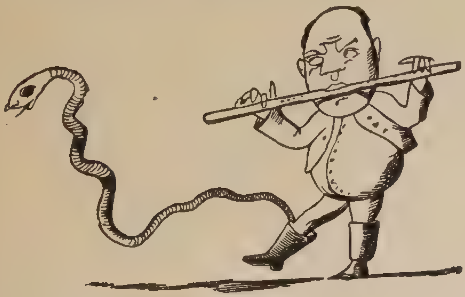
THERE was an old person of Rhodes,
Who strongly objected to toads;
He paid several cousins
To catch them by dozens,
That futile old person of Rhodes.



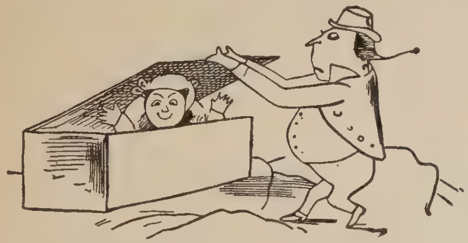
THERE was an old person of Basing,
Whose presence of mind was amazing;
He purchased a steed,
Which he rode at full speed,
And escaped from the people of Basing.



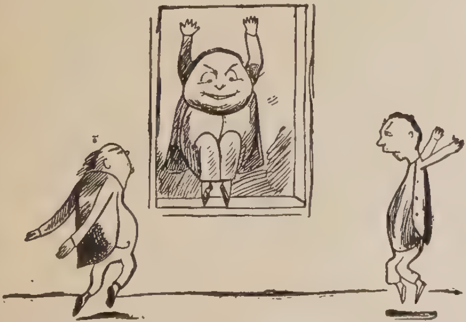
THERE was an old man in a boat,
Who said, "I'm afloat! I'm afloat!"
When they said, "No, you ain't!"
He was ready to faint,
That unhappy old man in the boat.



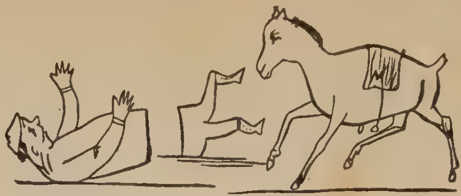
THERE was an old man with a flute,
A sarpint ran into his boot;
But he played day and night,
Till the sarpint took fright,
And avoided that man with a flute.



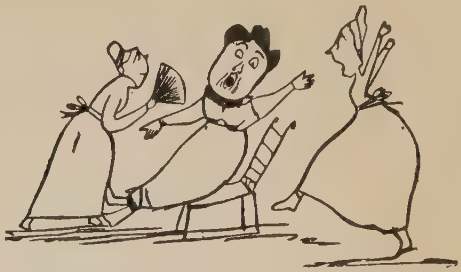
THERE was an old man on some rocks,
Who shut his wife up in a box;
When she said, "Let me out,"
He exclaimed, "Without doubt,
You will pass all your life in that box."



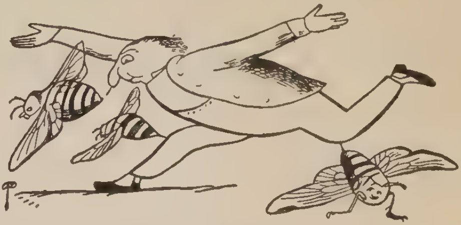
THERE was an old man at a casement,
Who held up his hands in amazement;
When they said, "Sir, you'll fall!"
He replied, "Not at all!"
That incipient old man at a casement.



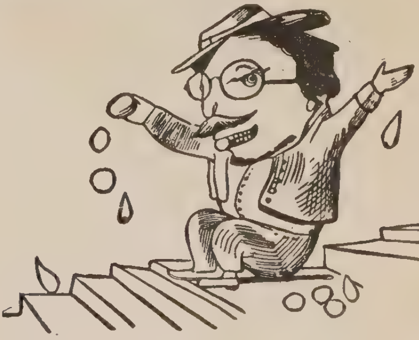
THERE was an old man of Nepaul,
From his horse had a terrible fall;
But, though split quite in two,
By some very strong glue,
They mended that man of Nepaul.



THERE was a young lady of Russia,
Who screamed so that no one could hush her;
Her screams were extreme,
No one heard such a scream,
As was screamed by that lady of Russia.



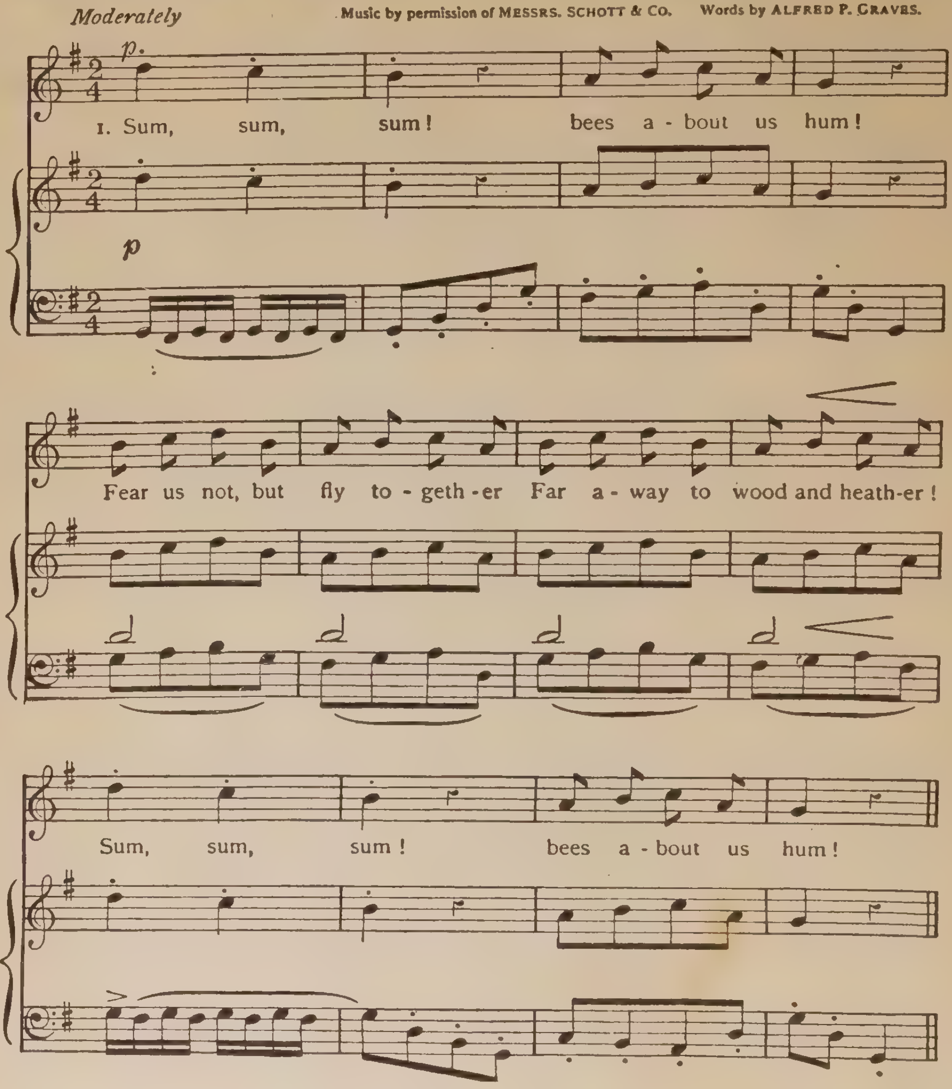
THERE was an old person of Dover,
Who rushed through a field of blue clover;
But some very large bees
Stung his nose and his knees,
So he very soon went back to Dover



THERE was an old person of Chili,
Whose conduct was painfully silly;
He sat on the stairs,
Eating apples and pears,
That imprudent old person of Chili.

THE BEES!

Music by permission of MESSRS. SCHOTT & CO. Words by ALFRED P. GRAVES.

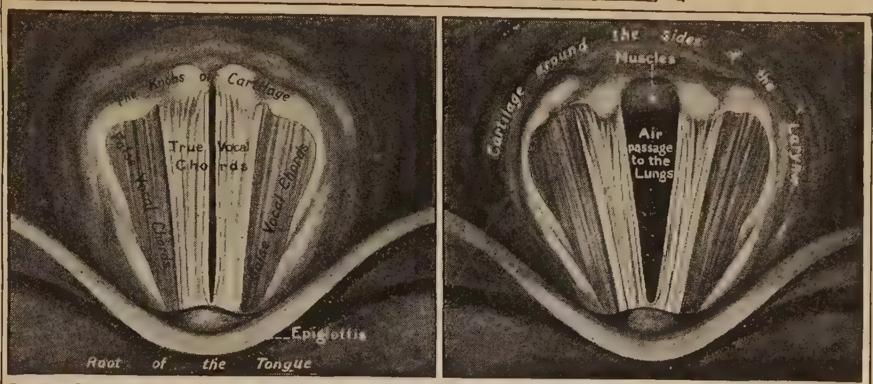

Moderately
p.
1. Sum, sum, sum! bees a - bout us hum!
p
Fear us not, but fly to - geth - er Far a - way to wood and heath-er!
Sum, sum, sum! bees a - bout us hum!

2. Sum, sum, sum! bees to business come!
You this flow'ret, you this flower,
Drain of dew, for pollen scour!
Sum, sum, sum! bees to business come!

3. Sum, sum, sum! bees now cease your hum!
Hiveward with your spoil come sailing,
Sweets to store for our regaling!
Sum, sum, sum! bees now cease your hum!

4. Sum, sum, sum! bees about us hum!
When the Christmas-tree is lit up
Through its flowers you'll seem to flit up!
Sum, sum, sum! bees about us hum!

5. Sum, sum, sum! bees about us hum!
Then the tapers bright will show you
All the honey-cakes we owe you!
Sum, sum, sum! while for joy you hum!



In the first of these pictures, which shows the larynx, or voice-box, we see the vocal cords in position for producing a sound. The air is forced through the narrow slit, vibrating the cords. In the second we see the vocal cords at rest. The epiglottis covers the larynx when we are swallowing.

HEARING AND SPEAKING

PRECIOUS THINGS IN OUR LIVES THAT BEGAN IN FISHES

CONTINUED FROM 3918

The inner ear would be quite sufficient to make the bone that contains it the most wonderful in the body. We know that that bone is the hardest in the body; and this is necessary not only because it forms part of the base of the skull and should be strong, but also, we suppose, because a hard bone conducts sound-waves better than a more loosely-built one.

We must understand that the important thing in hearing is for sound-waves somehow or other to get to the hair-cells. Much the best way is through the fine series of structures about which we read on page 3916; but though they are very useful, and though we cannot hear anything like so well without them, they are not necessary.

From the teeth, or from the bones of the head in general, sound-waves can be conducted—and, of course, are conducted, whenever we hear—which are conveyed very well by the dense bone that contains the inner ear, and so get to its hair-cells. Sound-waves reaching the ear in this way contribute to the keenness of our hearing, but, of course, they cannot compare for effectiveness with those that travel along the wonderful path made for the special purpose of hearing. But there is another reason why the bone that contains the inner ear is of very great importance and interest. It also contains another organ of a wholly distinct sense, which lies close beside the inner ear, and is, indeed, in more or less direct communication with it. For many years it was supposed that this organ was part of the inner ear, and was concerned with hearing. We now know that it has nothing to do with hearing.

The mistake was made more natural by the fact that one and the same nerve seems to run from the brain to both parts—as they were supposed to be—of the inner ear. In point of fact, what looks like one nerve, and is still called one nerve, is two wholly distinct nerves, as we can readily prove if we trace the course of the fibres towards the brain.

We find that the fibres which have come from the real inner ear all run to a certain part of the brain, the business of which is hearing. But we find that the fibres which have come from this other organ all run to an entirely different part of the brain which has nothing to do with hearing at all. In fact, what we are here dealing with is the sense of balance, and it is probably more or less of an accident that its machinery happens to be such a close neighbor to that of the sense of hearing.

A LITTLE-KNOWN PART OF OUR BODY THAT HELPS US TO STAND

This sense of balance is, in a way, a sense that tells us about the outside world, like hearing or vision; because it *does* tell us where the outside world is in relation to our bodies. But it is quite unlike the senses we know so well, as it is not arranged to receive anything from the outside world at all, and so, unlike the eye or ear, it has no connection with the surface of the body. We may say that this is one of the senses which tell the brain about the body, rather than about the world outside the body.

Before we study the organ of this sense, we must notice, in the first place, that it is helped by other means. We do not entirely depend for our balance upon the organs of balance in the base of the skull, though we certainly cannot balance ourselves without their assistance. When we stand, for instance—and standing is a very much more difficult matter than we usually suppose—our power of balance is greatly helped by the feelings we get from the soles of our feet. If something is painted on to the soles of our feet so that the skin there can no longer feel, or in cases of illness which have the same result, we cannot stand so easily as we usually do.

But the sense of balance is also helped by the eyes. As long as the eyes are open, even a person who is not helped by the soles of his feet may balance himself; or, with his eyes shut, he may yet balance himself if he stands with his feet far apart; but if he puts his heels together, and shuts his eyes, he will probably topple over on the ground.

THE GREAT USE OF THE EYES IN BALANCING THE BODY

People, however, can stand with their heels together, and with their eyes shut, thus doing without the assistance of sight, if the organs of balance in the skull are all right, and if guidance is also coming to the brain from the soles of the feet, and also from the muscles and joints of the legs. If we set ourselves the task of balancing on a very narrow plank, or, still more difficult, on a tight-rope, then our eyes become more useful, and, unless we are very skilful indeed, they are quite necessary. Everyone knows how the tight-rope walker keeps his eyes steadily fixed on a certain point, and so greatly helps himself. If he is very skilful, he may walk on the tight-rope even though he bandages his eyes; but this is far more difficult. However, the eyes and the feelings from the skin and joints and muscles are all unimportant compared with the guidance we get from the special organs of balance, and no one was ever yet able to stand or walk on the ground, much less on a tight-rope, in whom these organs were not working properly. Now we must learn of what they consist.

In the hard bone that contains the inner ear, and close to the inner ear—on each side of the head, of course—we find this organ of balance, of which a picture is given on page 3912. It consists of three tiny tubes, in shape like half a circle.

THE SIX LITTLE TUBES WHICH TELL THE BRAIN OUR MOVEMENTS

The proper name for a half-circle is a semi-circle, just as half a tone is a semitone, and the corresponding adjective is, of course, semi-circular; not a difficult word if we know how it is made up. The proper name for these tubes, then, is the *semi-circular canals*, and of these the head of every human being and of all the higher animals contains six, three on each side. They are all filled with fluid.

Just as the nerve of vision runs to the eye and the nerve of hearing to the ear, so the nerve of balance runs to the semicircular canals. The ends of the nerve—that is to say, the ends of the countless nerve-fibres which make the nerve—lie close to the fluid that fills the canals, and if that fluid moves, or if the pressure on it changes in any direction, the nerve-fibres know about it.

Now let us look at an ordinary child's block, which we call a cube. If we want to measure it, we find that it can be measured in three directions—from top to bottom, from side to side, and from back to front. We may pick up any solid thing, and we find the same is true of it. We may want to measure a room, and we find again that the same is true; we must measure the floor in both directions, and we must also measure the height of one of the walls.

In general terms, space has three directions—or dimensions, to give the usual word—and when we move our head it must move in one or more of those three directions. We may nod our head, or we may shake our head, or we may raise it up and down. All the possible movements of the head are either in one of these directions or in a combination of two or all three of them. Now, the business of the organ of balance is to acquaint the brain with every possible movement of the head, and it must therefore be so constructed that all possible movements shall duly register themselves in it.

This is done in the most exquisite way by the provision of three canals on each side of the head, these three canals being arranged in correspondence with the three dimensions, or directions, of space. One canal lies on its side, so to speak, or is horizontal; and the other two are upright, but at right angles to each other. As there is an organ of balance on each side of the head, we may think of the canals in pairs, and there is no doubt that they act in pairs. For instance, the horizontal canal on each side of the head acts with its fellow when we shake the head, or when we spin round, as we do in dancing.

THE MOVING FLUID IN THE SIX LITTLE CANALS IN OUR HEADS

The consequence of this arrangement is that every possible movement of the head has a strictly corresponding effect upon the fluid inside one or more pairs of these six canals, and the centre of balance in the brain is informed. This centre of balance probably exists in the cerebellum, or little brain. Sometimes we have an illness in which the organ of balance is thrown out of action, and just as a person whose eyes are injured cannot see, so those in whom the organs of balance are injured cannot balance. They suffer from persistent giddiness.

It has also been proved that where the injury affects only certain of the canals, the giddiness corresponds to the direction of the particular canal or canals in question. If it is only the horizontal canals that are thrown out of action, then we shall be all right so far as nodding the head is concerned, but directly we start shaking it, we shall become giddy, and, if we do not receive support, topple over.

The history of the semi-circular canals is deeply interesting. The lowest kind of creature with a backbone, as we know, is the fish, and we find in it one or more of these canals. Now, the fish is very clever at balancing itself, and shows no signs of giddiness; but probably we can explain why the fish manages so well without so many semi-circular canals, if we remember how great the pressure of water is upon the surface of the fish, and therefore how much more information the fish must get from its skin than we are able to get from ours.

HOW BIRDS ARE ABLE TO FLY WITHOUT TUMBLING OVER

As we ascend the scale of backboned animals, we find increasing development of these semi-circular canals, though they do not all appear at once. If our statements as to their use are correct, we should expect to find them most beautifully and perfectly developed in birds, which could not succeed in flying without a perfect sense of balance. In flying, the bird gains little from the feet and legs, as we do in the very much simpler business of standing or walking; and therefore its need of special organs of balance is all the greater.

So we find the semi-circular canals at their very best in birds, and we know also that, just as in our own case, if the canals are thrown out of action, the birds power of balance is destroyed, and in flying it will make mistakes and show peculiarities corresponding to the particular defect in its organ of balance. It is probable that in this way we can explain the peculiarity of what are called "tumbler" pigeons.

It used to be thought, before these newer facts were discovered, that the semi-circular canals had something to do with hearing; and we can understand how natural this idea was, seeing that the canals look as if they were part of the inner ear, and their nerve looks as if it were a part of the nerve of hearing.

THE LITTLE ORGANS IN OUR EARS THAT HAVE NOTHING TO DO WITH HEARING

The idea used to be that probably we somehow judge of the direction of sound by means of these semi-circular canals.

No one could look at their singular arrangement without feeling that their business had something to do with direction. But we now know that their business is with the direction in which the head moves, and not with the direction of sound. It is much more important to know what the head is doing than to know where sound comes from, and, in any case, by having external ears that can be moved, a creature can easily enough judge of the direction of sound without any special machinery inside its head. If we human beings are not so well off in this respect, it is because we have lost the power of moving our outer ears like the animals.

THE FISH'S GILLS, UPON WHICH MANY PRECIOUS STRUCTURES ARE BUILT UP

We have lost this power that the animals have, but we have gained many things that the animals have not. In the very lowest vertebrate animals, such as the simplest fishes, and also in the higher fishes, too, we find, instead of lungs, what are called gills. To these the blood runs, as it runs to our lungs, and in them it comes in close relation with the oxygen dissolved in the water, just as in our lungs the blood comes in close relation to the oxygen of the air. The gills have to be supported on something, and so we find in the fish five gill-arches, with slits between them called gill-slits.

Gills did not develop into lungs, but lungs developed from a quite different organ, called the swim-bladder, of the fish. Now, we might suppose that when backboned animals left the water and began to breathe air, no use was found for the gill-slits and gill-arches, as the gills were not made into lungs. But some of the most wonderful and precious structures of the higher backboned animals have been developed from the gill-slits and the gill-arches.

HOW THE SWIM-BLADDER OF THE FISH BECAME THE LUNG OF THE ANIMAL

We can never tell to what uses Nature will turn a thing, and the history of life upon this earth proves over and over again that organs which would appear to have lost all their use, and of which nothing could be made, may be turned to new and utterly different purposes. According to some scientists Nature took the swim-bladder, which used to be filled with air, and helped the fish to swim at the level it liked, and made it into a lung, when the creature no longer swam under the surface at all.

With the gill-arches she has done things much more wonderful than this. In the first cleft of the gill-arches the whole of the ear was developed. As we have learned, the ear is more than an organ of hearing. It is an organ of balance as well. Not only the little bones, through the aid of which we hear, but also the wonderful semicircular canals have grown from this simple structure. There is nothing more wonderful than this in the whole story of the human body.

But there is more of the strange story. Scientists who have studied the human body tell us that much of the structure of our faces has also grown out of the gill-arches. The bone at the root of the tongue and all the structure which enables us to speak are developments. All of the voice-box, or larynx with its rings of cartilage, has grown out of the apparatus which made it possible for a fish to breathe. The gill-arches were used entirely to enable a fish to get air in water. The use of the larynx requires air, to be sure, but in a different way.

THE VOICE-BOX, AND THE SERIOUS PART IT PLAYS IN OUR LIVES

Now, instead of going on to study another sense at this point, it is much better, for two very good reasons, that we should go on to study the larynx. First, we should do this because then we shall be studying together the various organs that have been developed in the higher animals from the gill-arches of the fish; and, secondly, we should do so because it is well to study the means by which we produce sounds, after studying the means by which we hear them.

We all know something, at least, about the larynx, because we have all seen the front part of it pushing the skin forward and sometimes moving up and down. There is a foolish notion that this is the apple which Adam swallowed, and which stuck in his throat, and so it is sometimes called Adam's apple. A larynx, or voice-box, similar to ours is to be found in all the higher animals, and, as we know, it is simply a stringed musical instrument. In the case of the birds, many of which have such beautiful voices, there is besides this stringed instrument another, which is practically an organ-pipe. But, in all its forms, and whether with or without this organ-pipe, the larynx is evolved from one of the gill-arches of the fish. This voice-box, of course, is not only concerned with speaking and singing; it has important duties to perform every moment of our lives, because it is the channel of the breath of life. Further, owing to the manner in which the lungs have been developed in long-past ages, it has so occurred that the opening from the throat to the voice-box lies in front of the opening from the throat to the gullet.

Only the study of the way in which living things have developed one from another can enable us to see any meaning in this arrangement, which, as we know, makes it necessary for everything we swallow, whether liquid or solid, to be thrown over the opening to the larynx without entering it. There is thus placed upon the larynx another duty besides that of producing sound, and that of attending to our breathing, for it has to protect the air-passages every time we swallow. This organ is made of pieces of what is called *cartilage*. Our ordinary name for cartilage is gristle, and we may describe it as something which is half-way towards bone.

THE NARROW CHANNEL THROUGH WHICH PASSES ALL THE BREATH OF LIFE

In old age the cartilages of the larynx get to be not exactly bony, but more chalky and rigid than they are in youth; and this, probably, is one of the reasons why most people with sensitive ears can readily distinguish a young voice from an old voice.

The business of the larynx is to support and control the action of two tiny cords or strings called the *vocal cords;* that is to say, the voice cords. The picture on page 1648 shows what the vocal cords look like when they are seen from above by means of a bright little mirror held at the back of the throat. We see that the vocal cords have a free edge towards the middle, and that from it they pass outwards to the sides of the larynx.

All the air by which we live passes through the narrow space between the vocal cords. The arrangements by which they can be put together or separated are quite simple. They part every time we breathe in, and when we choke and cannot breathe in, it is because the vocal cords are not parting as they should. But if the cords are to produce voice, they must be able to do much more than this. It must be possible to hold them tightly stretched, so that when air is forced against them they will vibrate. Nor is this all, for it must be possible to stretch them in different degrees. As we shall learn when we come to study sound, the pitch—the shrillness or the lowness—of a musical note produced by anything trembling depends upon a number of things, such as its weight, its length, and its tightness.

THE WONDERFUL MUSICAL INSTRUMENT WITH ONE STRING

Now in the case of a piano, when we want to produce notes of different pitch, we have a number of strings of different lengths laid side by side, so that we can strike the one that gives out the required note. Also, we can have some of them made of much heavier material than others. In the case of the violin, it is possible to have only very few strings, but we can produce all the notes we want by stopping the strings with our fingers, so that the length of string that is free to vibrate can be altered as we please; and the strings are made of different weight and thickness.

But in the larynx there are only two strings, and these always act together, it being impossible to produce voice with one of them; moreover, they are of the same weight and length. Outside the human body, a musical instrument that had practically only one string, and that could not be stopped at different points like a violin string, would not be able to produce much variety of pitch. The only possible way of getting any variety would be to have some means of varying its tightness. It is probably correct to say that there is no material other than that made by life that can be tightened in such different degrees as the needs of music demand, without permanent injury to the strings.

THE MARVELOUS POWER THAT A GOOD SINGER HAS OVER THE HUMAN VOICE

But though our vocal cords have only the one possibility of varying pitch, due to the fact that they can be tightened in different degree, with this one means they triumph. A good singer can produce all the notes in a range of two octaves, and many singers are able to exceed this compass considerably. Outside the body there is no parallel to this. It is interesting, therefore, to know of what the vocal cords are made, so that they can stand such varying degrees of tightness, within a few seconds, without injury. They are simply made of fibres of what we call elastic tissue, such as is found in various parts of the body wherever it is needed. But an ordinary piece of elastic is rubbish compared with the elastic tissue made by the body.

HOW THE VOCAL CORDS ARE TIGHTENED TO PRODUCE DIFFERENT SOUNDS

The next question is—How is their tightness varied? In front, just behind the part of the voice-box that we see from outside, the cords are fixed to the largest cartilage of the larynx, but, behind, each of them is fixed to a tiny little knob of cartilage which is delicately jointed to the part that it rests on, so that it can be tilted in several directions.

What really happens when we sing is that these little knobs of cartilage are tilted backwards so that the cords are made tighter when our voice ascends in pitch, and are tilted forwards so that the cords are made slacker when our voice falls in pitch. This is easy to say, but the picture on page 3997 will show what the cords are like; and the muscles which do all this work are tiny little shreds.

When a singer is producing one of his highest notes, the cords have to be so tight as to vibrate four times as often in every second as when he is producing one of his lowest notes. Thus, in the whole range of Nature, there is scarcely anything more perfectly delicate than the control which a singer has over this tiny little machine to produce such results.

WHY THE HUMAN VOICE IS MUCH MORE MARVELOUS THAN A PIANO

Nor must we suppose that the singer is merely limited to the number of notes that there are on the piano in two octaves. Pianos vary in pitch, as we know, and a singer can tune his voice to the pitch of any piano he sings with. Skilful singers can produce several tones, even as many as eleven, between two notes that are next to each other on the piano.

As we have said, all this depends on the tightness of the cords, and the tightness depends on the strength with which certain tiny slips of muscle pull upon the cartilages to which the cords are attached; and that depends upon the force of the nerve-current sent to the nerves through these muscles from certain nerve-cells in the brain. The place, therefore, where the unrivaled delicacy of this machine really exists is the nerve centre in the brain.

As everyone knows who has tried to read a song of which he was not sure, or as anyone may observe who watches a child learning to sing, it is one thing to have all the machinery for producing a note that is easily within the range of our voice, and it is quite another thing to be able to produce that note when we wish. There are two stages of difficulty here, and the second is marvelous beyond anything we have yet described. The first of these is where we simply imitate a note we hear.

This is quite wonderful enough, for it means the beautiful working together of the cells in the hearing centre of the brain with the cells of that part of the brain which gives orders to the muscles of the voice-box.

THE MYSTERY OF THE WRITING AND SINGING OF MUSIC

But now take the second case, where a singer sings aloud the notes of a piece of music that he has never seen before. What is it that he imitates now? What is it that guides him? We can only say that the singer imitates, or realizes, his idea of a certain sound that he has in his mind, but what and where the idea really is, and how the singer can do what he does, no one can say, for we are here in the realm of the mind—the most mysterious of all things, and it baffles us utterly.

Lastly, we have the case of the composer sitting down with a pencil and a sheet of paper, and creating music "out of his head" for other people to sing and play. Some of the greatest music ever written—music which has made miserable people happy, and cowardly people brave, and frivolous people solemn, and will do so to the end of time—was written by a man named Beethoven many years after he had become stone-deaf. He never heard a note of the greatest and most wonderful part of the music that he wrote; and yet, in his minds ear, he heard it better than anyone has ever heard it since, or he could not have created it.

THE NEXT PART OF THIS IS ON PAGE 4093.

We should hardly think that there is any connection between this picture and a piece of rope. Yet here we see rope growing in the shape of hemp. This kind of hemp is called Sisal hemp, because it grows at Sisal, in Yucatan. There are miles and miles of hemp plantations like this in Mexico.

A PIECE OF ROPE

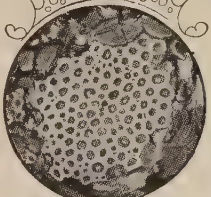
CONTINUED FROM 3854

THERE is a baby rope in the cages of most song-birds. It is in the seed-pot. If we look we shall find only seed: canary-seed, rape-seed, mustard-seed, perhaps, and hemp-seed. It is the hemp-seed that is the baby rope.

If we were to sow some of those seeds, we should find that they would grow, in rich, damp soil, fed by the hot sun, into great plants. To see the best American hemp we must go to some parts of Kentucky, or better yet, to California. But foreign hemp is to be found under the blazing sun of the tropics, and in the cold lands of Northern Russia.

It is the stalk of the plant that we need for our ropes and strings and twines. Upon it grows a bark made up of fibres. If we want fine fibre to make cloth, we pluck up the plant as soon as it has flowered. If we want coarser fibre for the making of sails, we let it grow a little longer. If we want the coarsest of all—for strings, and cords, and ropes—we let the hemp grow as long as it will.

So much for the baby rope which we see in the cage-bird's seed-pot. But there are various other things which make ropes. Those brown ropes which are never tarred, and are so much lighter than hempen ropes, are made from the husk of the cocoanut, and are called coir ropes. Then there is a fine rope, used in the driving of machinery, made of cotton. But the most wonderful rope is made from a plant named the *abaca*, and more generally called Manila hemp. It grows in the Philippine Islands, and the islanders receive about $20,000,000 a year from it. The natives split the leaf-stalks into long strips, beat them with clubs, then wash and dry them.

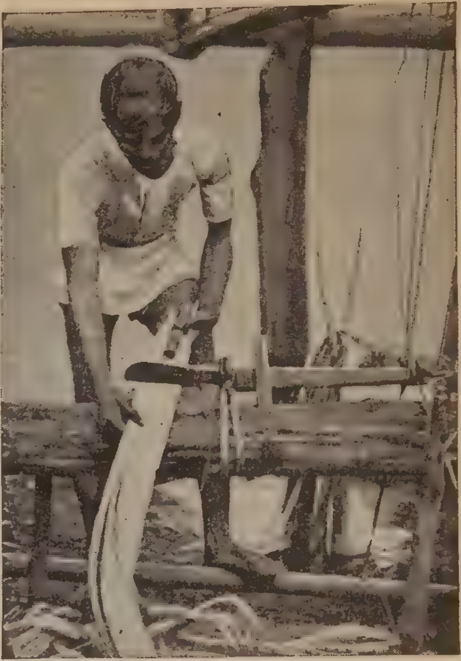


MANILLA FIBRE

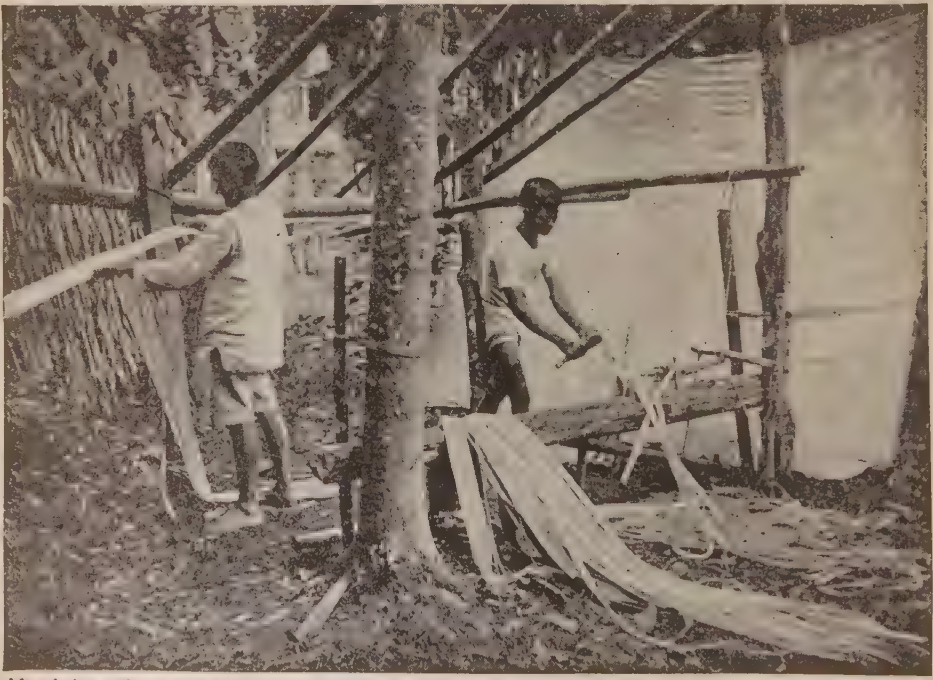
The making of rope is now an elaborate process in which very wonderful machines are used. In making rope by hand, the fibre of the hemp is separated from the stalk by long soaking in water. Then the fibre has to be divided, and the short lengths removed. The long pieces are laid parallel to each other, and the ends are attached to a revolving hook. The workman winds some hemp round his waist, and walks backwards, twisting the pieces, fitting them into the strand that he is making, and shaping them properly. All the time the hook to which the end is fastened continues to spin round. Very little rope is made in this way, as machinery, of course, does this very rapidly.

GETTING THE HEMP READY TO MAKE ROPE

Manila hemp, which grows in the Philippine Islands, differs very much from the Sisal hemp, shown on page 4003. Sisal hemp is something like mammoth grass, but Manila hemp is taller and looks like a palm.



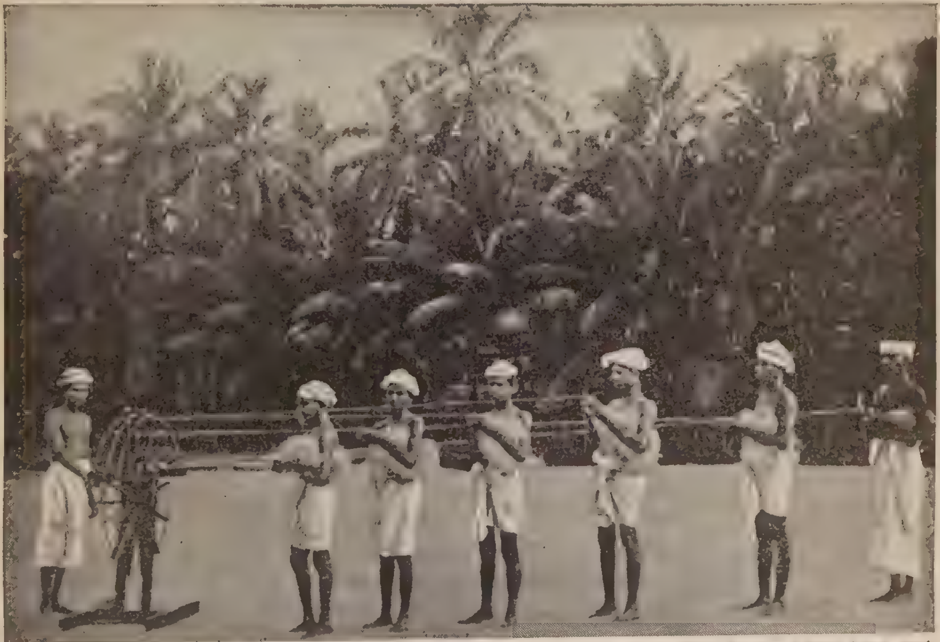
The leaf-stalks of the hemp are stripped from the trunk and then the natives of the Philippines split the stems into lengths two or three inches wide, using a kind of bamboo knife, as seen in this picture.



After being stripped and split the hemp-stalks are scraped, as shown here, until only the fibre remains. Then this fibre is washed and dried, and packed into bales ready to be sent all over the world. Two men workinng all day can prepare 25 pounds of hemp, and it takes 3,000 trees to produce a ton, worth from $150 up.

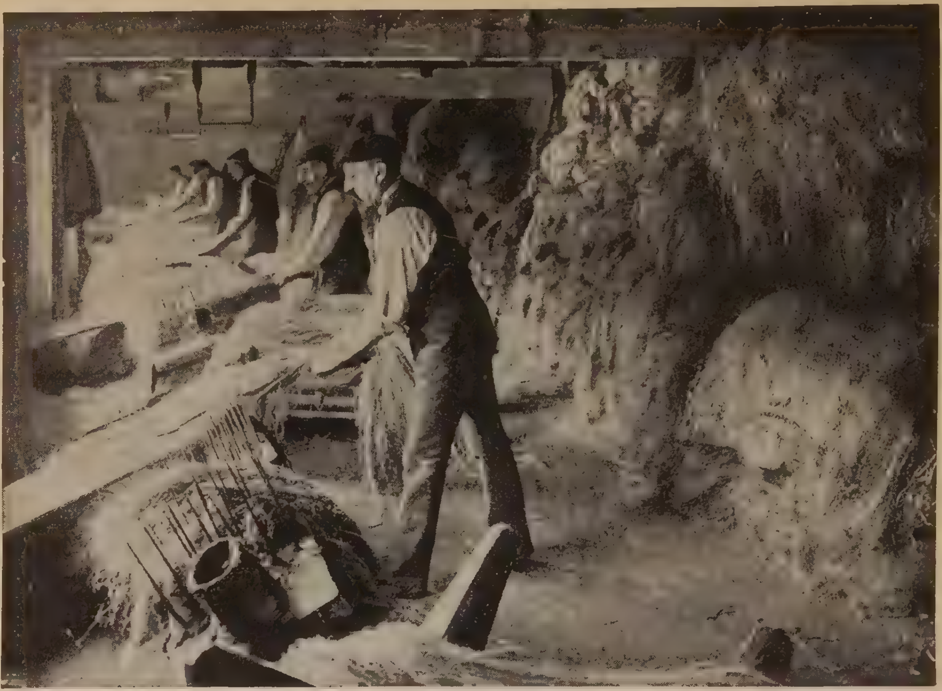
MAKING ROPE FROM COCOANUT SHELLS

A very elastic rope is made from the outer covering of the cocoanut, which, as we know, is quite fibrous, or stringy. The husks are first gathered in heaps, as shown in this picture, and then soaked for months in water to make the fibres soft. The cocoanut fibre is called coir, which is from an Indian word meaning rope.

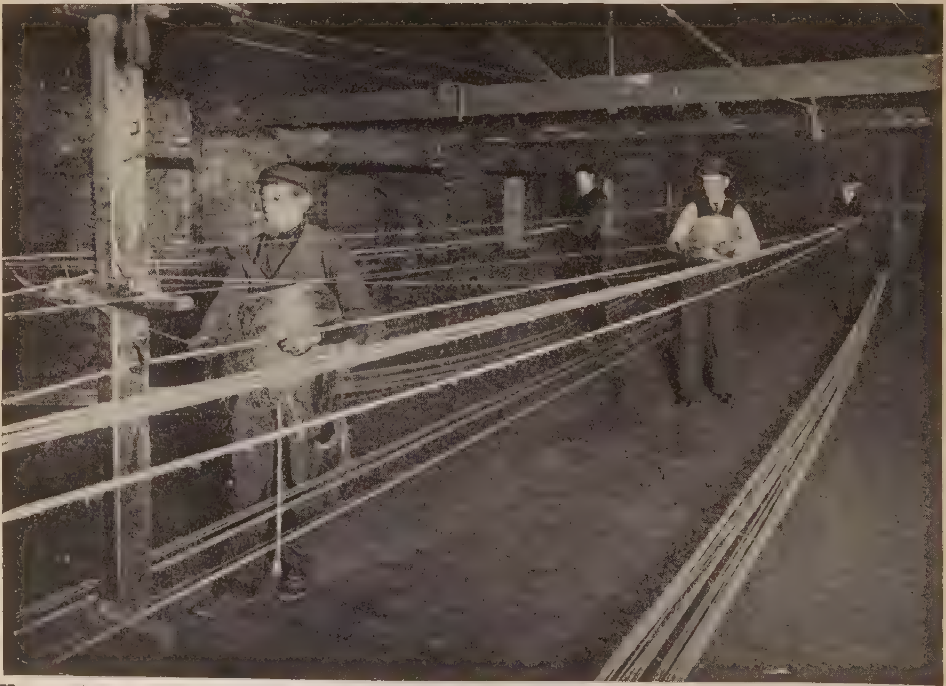


Coir rope is made in India and Ceylon with simple machinery. A number of natives stand, as seen here, each with a bundle of prepared coir under the left arm. The ends are fastened to a wheel, which a man turns, and as more and more fibre is added, the rope grows longer and longer. Coir ropes are very strong.

THE OLD WAY OF MAKING ROPE BY HAND



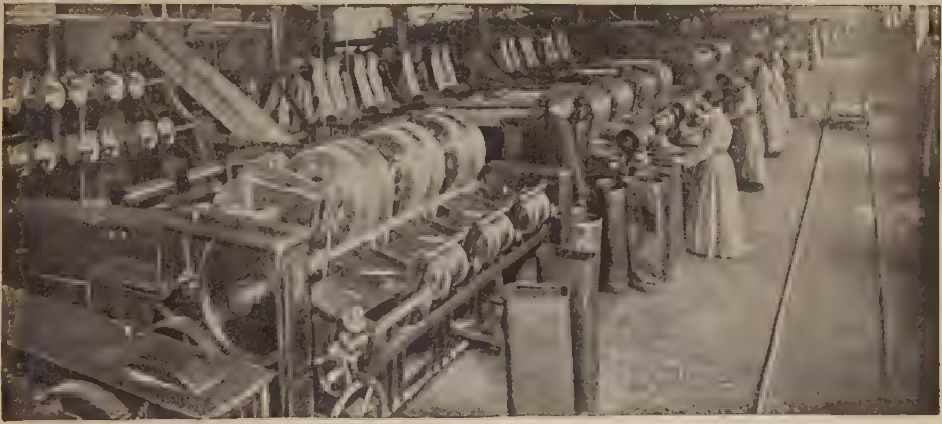
The old-fashioned way of making rope by hand is dying out, although it still exists in some small rope-works. Here we see men combing out hemp by drawing it through a series of long spikes fixed into boards that look like inverted rakes. The men work quickly, but it takes a long time to prepare a ton of hemp by hand.



Here we have an old-fashioned rope-walk; but there are not many places in America to-day where we can see a scene like this. The method is very much like that shown on page 4005, each fibre being added by hand, the workers becoming wonderfully expert and quick in making ropes of the same thickness from end to end.

THE MODERN WAY OF MAKING ROPE

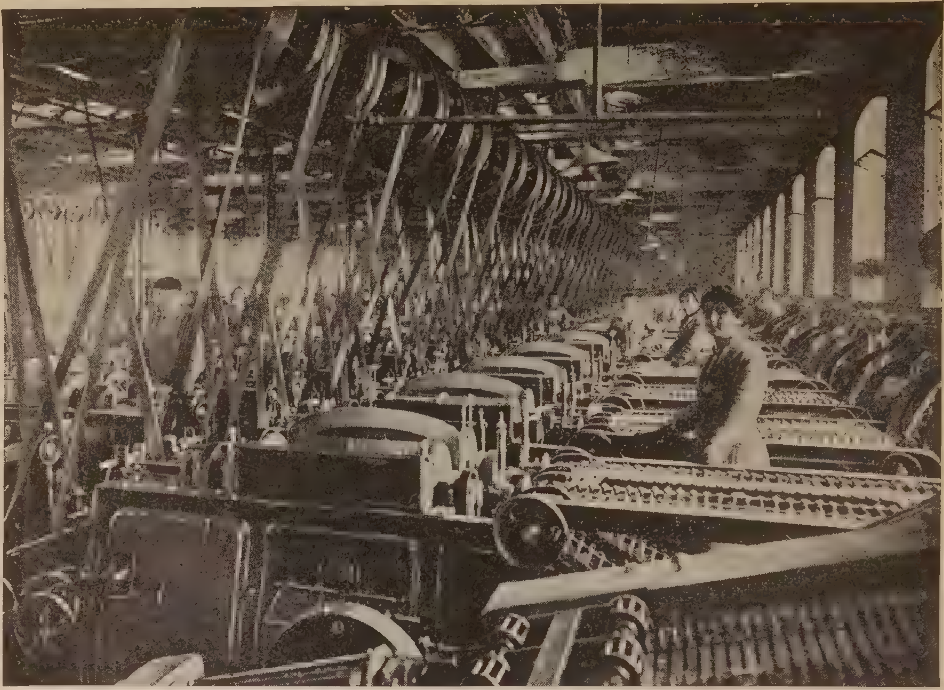
This picture shows the first process in making rope in a modern factory. The hemp is taken from the bales and fed into a machine called a spreader, which spreads out the hemp so that it may be easily dealt with.



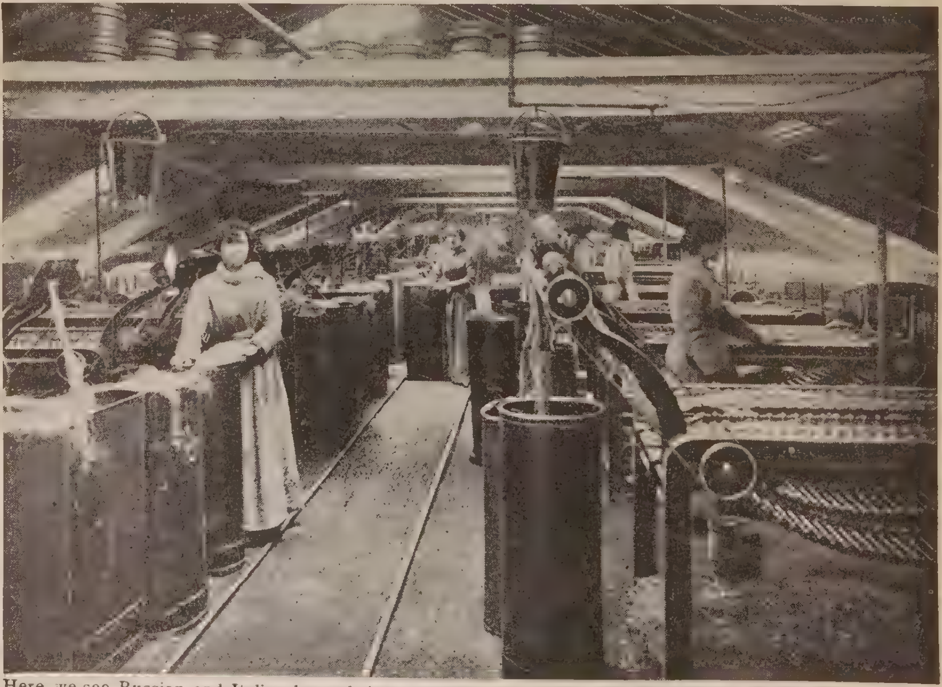
After being spread, as in the picture above, the hemp goes through other processes, and is then combed, or drawn, out by machines like these. It runs into iron cases, and is wheeled away to the spinning-room.

Although hemp for the strongest ropes comes from the Philippines, we receive a great deal from Russia and Italy. This is true hemp; for Manila hemp is not really hemp at all, but is from a different kind of plant altogether. Here we see women preparing Russian and Italian hemp. All machinery used in rope-making is elaborate, and works rapidly. Each machine in the top picture prepares 10,000 pounds of Manila a day.

SPINNING THE HEMP INTO ROPE & TWINE

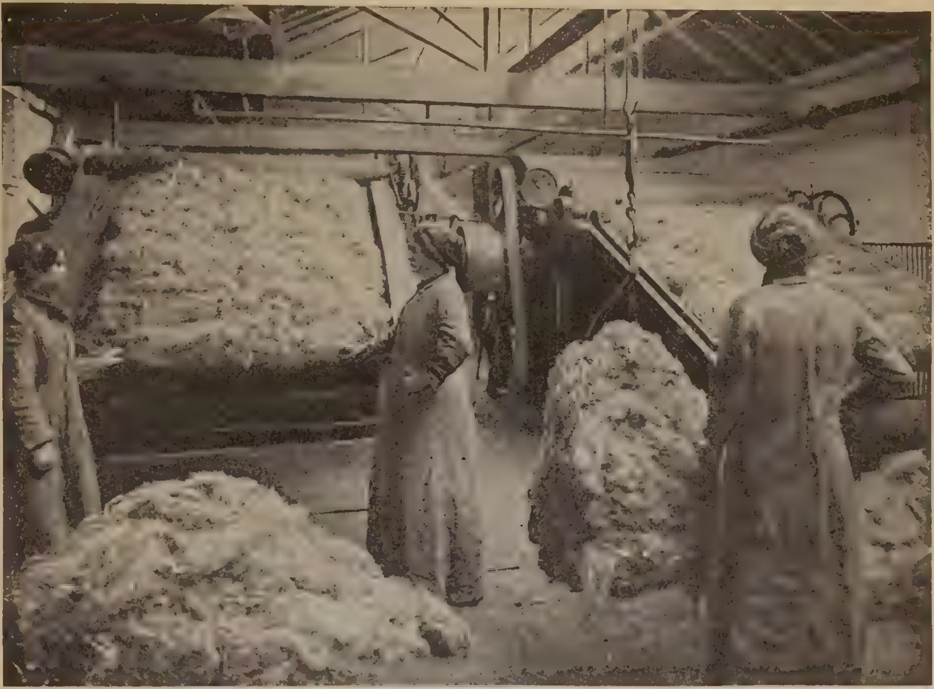


In this room twine for fishing-nets is being made, and there are 150 spinning machines at work. If we went into the room, we should be deafened by the whirring of the wheels; but the workers get used to it.

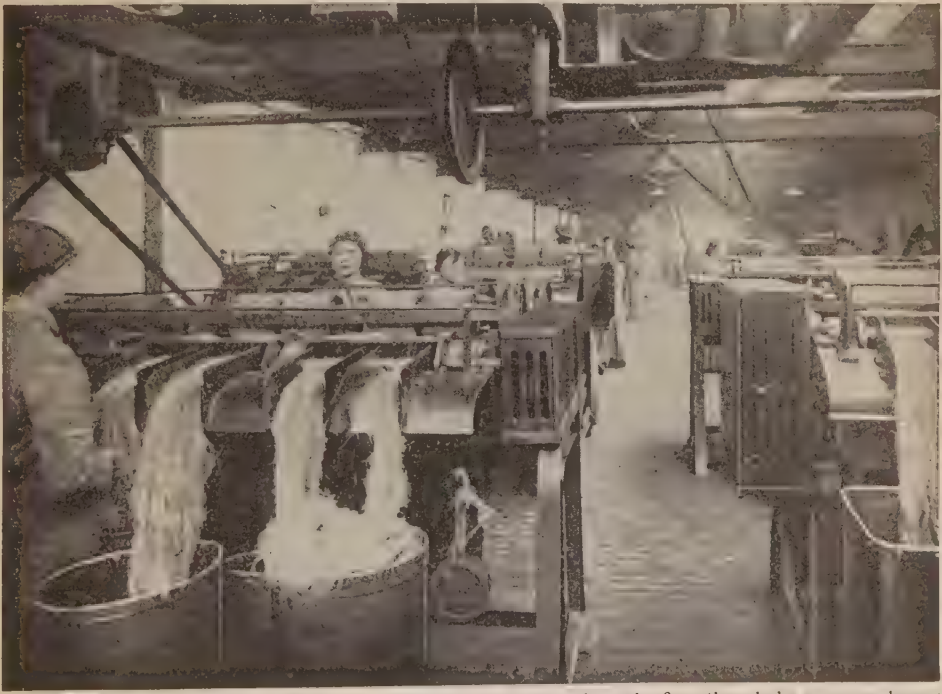


Here we see Russian and Italian hemp being spun into rope. More than 100 years ago, Dr. Edmund Cartwright, who invented the power-loom for cotton-weaving, made a rope-spinning machine which he called a cordelier, and it is on this that the magnificent modern machinery for rope-making is based. Cartwright received $50,000 from Parliament for his inventions, which had added to the prosperity of the British nation.

COMBING OUT THE TANGLED HEMP



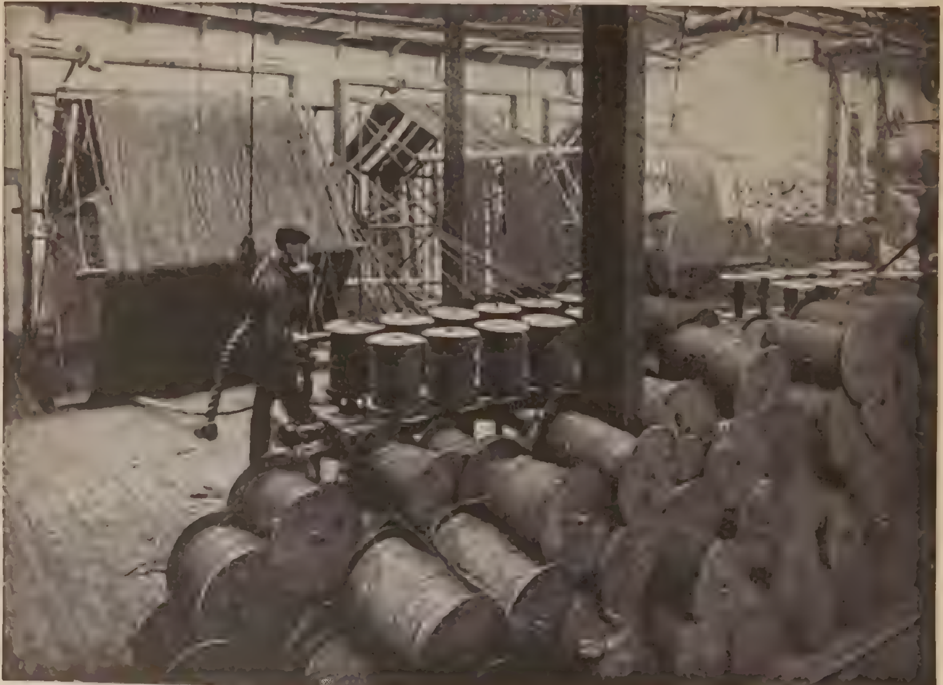
When we see heaps of hemp, such as are lying in this room, it seems impossible that the tangled mass could ever be unraveled. But by passing it through a machine called a carding machine, it comes out quite clear.



The coarser parts of hemp are called tow, and these are separated from the finer threads by a process known as hackling, the hemp being placed in a machine that has two endless bands studded with spikes. Here we see the tow being combed out in the drawing-room ready for spinning. The word tow simply means fibre.

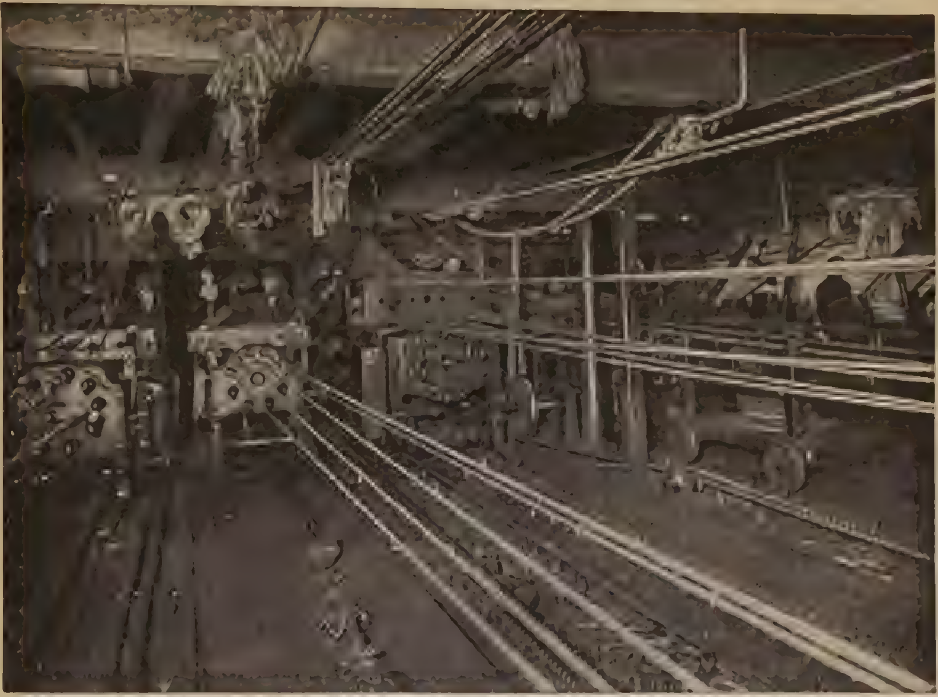
WINDING & STORING THE TARRED YARN

A great quantity of yarn, or hemp fibre, is tarred ready to be made into tarred rope; and in this store we see 150 tons, or 336,000 pounds, of the tarred yarn waiting to be wound on to spools, or reels.



This is how the tarred yarn is wound on to huge spools before being spun into a rope. In the foreground we see the full spools, to the left of the post are some spools just ready to be lifted from the winding machine, and on the right are some empty spools just being filled. The spools are wound twelve at a time.

THE ROPE FINISHED AND READY FOR USE

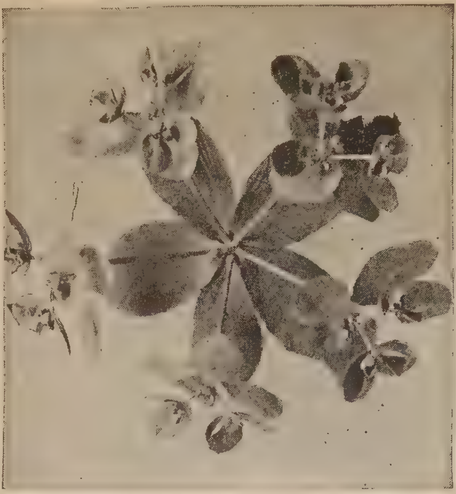


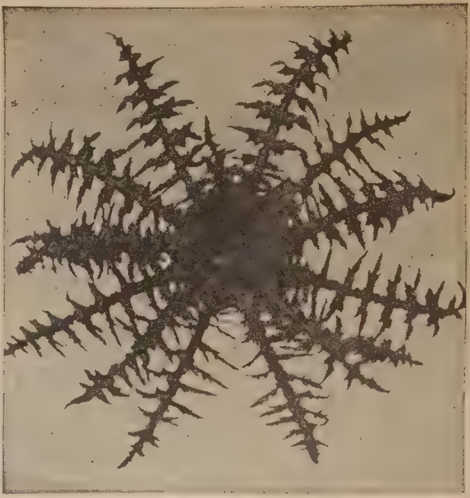
This is a present-day rope walk. Instead of one or two men walking the length of the alley with the hemp in their hands, elaborate rope-making machines run on rails; and in the rope-ground shown here, which is 1,200 feet long, as many as 18 tons of rope can be made in a day. The length varies according to the weight.

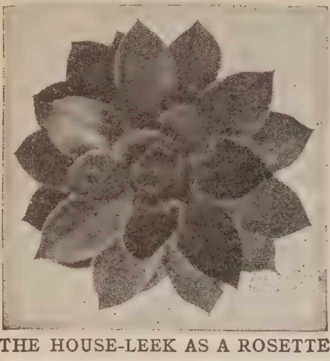
Here we see the finished rope. The United States manufactures much rope and twine, and sends abroad a large quantity of rope and string every year. This if joined would go round the world many times. One of the longest manila ropes ever made in one piece was over eleven miles long and cost nearly $12,500.

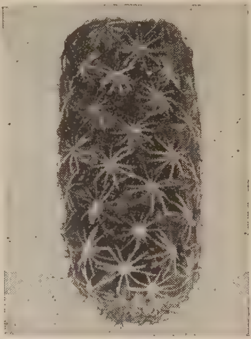
THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4057.

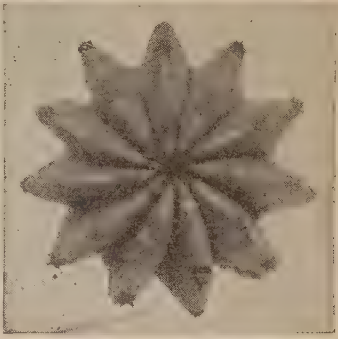
THE PLANT AS A PATTERN-MAKER

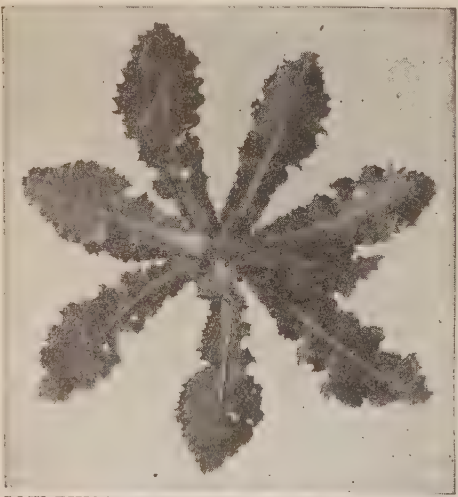

THE LEAF ARRANGEMENT OF WOOD-SPURGE

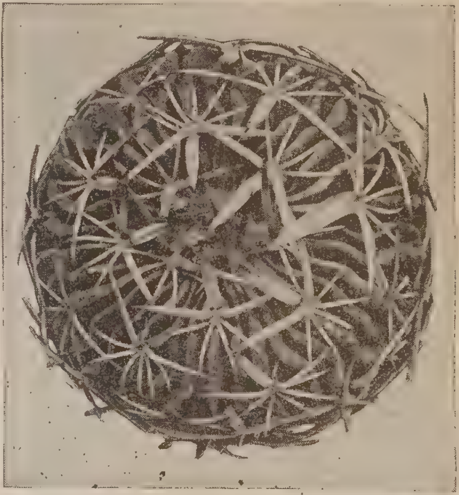

A PRETTY STAR-PATTERN OF THISTLE LEAVES


THE HOUSE-LEEK AS A ROSETTE


HAIRS ON A CACTUS


THE SEA-URCHIN CACTUS


SOW-THISTLE'S LEAVES ARRANGED AS A STAR


A CACTUS STUDDED WITH PRICKLY STARS

We know what beautiful and varied designs are traced by Nature when she is making crystals like snowflakes, and forming some of the creatures that live in the sea, like anemones and starfish, as we see on page 2407. But it is not only in the animal and mineral kingdoms that Nature is a pattern-maker. Many plants, as they grow, form regular designs with their leaves, and here we see striking vegetable stars and rosettes.

Flowers are visited by insects that carry the pollen, and according to the habits of the insect that visits it, a flower opens early or late. On the left we see goat's-beard, and on the right, scarlet pimpernel, that open early in the morning; and in the middle, white campion, that opens at evening.

THE HABITS OF FLOWERS

CONTINUED FROM 3952

WE know that plants differ in their liking for certain kinds of soils, as well as in choice of locality. Further, they often show a strong preference for either dry or wet ground; that is due to their degree of thirst, that, in turn, may be said to depend upon the thickness of their skins. The plants and trees we call evergreens are not thirsty because their leaves have hard, polished skins which do not allow the water in the plant to evaporate.

The less quickly the water is lost by the leaves the less work the roots have to do in sucking up moisture from the earth; therefore, of succeeding crops of plants which have been forced to grow in dry localities, those with the toughest skins have survived, and gradually each kind becomes perfectly protected as to foliage, and sometimes as to stems, against this loss of water, thus being comfortable where thinner-leaved plants would soon perish. That is why the cactus and the stonecrops can flourish on the driest, hottest, and stoniest soils.

It also follows that if we take the plants that grow in any place, and closely look at the different kinds found there, we shall find that they all agree pretty much in the structure of their leaves and stems from this point of view. If we climb a sunny hillside to gather flowers, we shall get spotted boneset, butterfly weed, and columbine, or white or golden daisies. Now, if we gather a bunch of these to carry home, they will not wither in our hands. But if we go along the riverside and gather meadow-sweet, forget-me-not, or fringed gentian, we shall find them all hanging their heads when we get home, and they may not revive when we put them in water.

If the seeds of the waterside plants are carried to the heath or those of the heath plants are taken to the waterside, they may sprout, but they will never become full-sized plants, because they are not fitted for growth under such conditions. When we have learned that a certain kind of plant grows by the river, or in a marsh, we shall never expect to find it growing on sandy or rocky soil. And so we shall find that we can safely describe a plant as a rock plant, a hedgerow plant, a woodland plant, a waterside plant, a field plant, or a plant of some other dwelling-place.

When we come to read books on botany we shall find the special haunt of a plant spoken of as its *habitat;* but if we remember that habitat means simply the place the plant inhabits—its dwelling-place—the word will not be a hard one.

All plants have their proper flowering time, and they are so precise that we may go out to find their flowers at the usual season and be sure to find them; that is to say, in any year when the weather is what we have a right to expect about that date. In some years the spring is late because the cold of winter has continued much longer than is usual. In such a year the spring flowers will also be late, for they go by seasons rather than by days of the month. They put out their flower-buds and open them when the weather is most suitable for their purpose.

But what we should like to learn is *how* the plants know when is the right time. How do the snowdrops and crocus bulbs buried in the ground know when the frost has gone? How does the almond-tree get its beautiful pink flowers out before its leaves are seen? How does the coltsfoot, that has not a leaf above ground, get word that the time has come to send up its yellow flower-heads? They do not know beforehand exactly when that time will be, but they know it will come, and that they must be ready for it.

HOW THE PLANTS WAIT FOR THE SUN BEFORE PEEPING OUT OF THE GROUND

And at the end of the autumn the snowdrop and crocus fit themselves out with a new set of roots, and their flower-buds and leaves having already been formed, though still very tiny in size and hidden right in the heart of the bulb, they set to work piercing the earth with their leaves. But before they reach the surface they find it is very cold—perhaps the top soil is frozen hard—and they rest. Then, when the thaw comes, the warm spring rain soaks down through the soil, and the plants know they may safely break through the surface.

There may come a change, and for some days, or even weeks, only the tips of the leaves show. But when the mild weather has really set in, the leaves are rapidly enlarged, the flower-buds are pushed up, and a very little sunshine will cause them to open out.

We must not imagine that the plant forms its flower-buds only a short time before they open. With garden *annuals,* the seeds of which we know are not sown until March or April, there cannot be any getting ready much in advance of the flowering time, but with the bulbous plants and spring-flowering trees and shrubs the flowers in their buds were all formed by the autumn before.

THE WONDER OF THE BUDS IN WHICH THE TINY FLOWERS ARE HOUSED

When we go gathering wood-nuts in the autumn we can see pairs of hard, grey tassels hanging from the twigs. These are the lamb's-tails that will be long, soft, and yellow in the spring. While we are picking ripe apples from the tree we can tell which of the buds are leaf-buds and which are flower-buds, by the latter being much more plump than the former. When hyacinth bulbs are bought in the autumn for planting in the garden, if we look into the hole at the top we can see that the tiny flower-buds have already formed.

What seems more wonderful than plants being affected by the seasons, is the way they know the time of day. We have day flowers and evening flowers; but the day flowers do not all open early in the morning, neither do they all remain open until the sun sets. The morning glory, which is a summer flower, opens very early in the morning, and is often closed by ten or eleven; almost always before twelve o'clock. Its beautiful pink and purple flowers turn a commonplace fence into beauty.

The pimpernel always closes early in the afternoon, like most other flowers that open early in the morning. None of the evening flowers open before about six o'clock. If we look at the moon flower in the garden by day, we shall find all its flowers are closed, limp, and discolored. But early in the evening, if we watch it, we shall see the fresh buds burst suddenly, and the beautiful white petals expand before our eyes. At the same time their strong, sweet perfume will fill the air. We may observe the white tobacco plant of the garden and the white campion of the grainfield behave in much the same way.

A CLOCK THAT TOLD THE TIME BY THE OPENING OF THE FLOWERS

Linnæus, the great Swedish botanist, was so struck by the way in which so many flowers kept regular hours for opening and closing that he made a floral clock by planting a bed with plants which opened their flowers one after the other. Of course, such a clock could only be used in summer time.

There is no doubt that plants can tell what is the time of day by the amount of light, and until the proper strength of light is reached the bud of the plant does not open. But this does not explain the whole matter, for there are times of day when the evening light is of the same strength as the morning light.

HOW THE FLOWERS OPEN IN TIME TO RECEIVE THEIR INSECT GUESTS

During the summer months, when the greatest number of plants flower, the light at six o'clock in the evening is just as intense as it was at six o'clock that morning So the plant that should flower in the morning must have some other means of telling the difference between morning and evening, and it is not easy to say how it does so. There can be little doubt that plants have some special powers of which we know little or nothing.

Why one plant opens in the morning and another in the evening is a question that we can answer without much trouble. All flowers that invite insects to fetch and carry pollen for them must take care to have their flowers open during the hours those insects are flying about. If they are not open at these times, their bright colors and nectar to attract and reward will be wasted, and, worse than all else, they will produce no seed. Therefore we find that as bees are abroad early, the flowers that want their aid are also open early. Few butterflies are about before nine or ten o'clock, and so the butterfly flowers only open about that time, and close about five or six in the evening. Few moths fly before dusk, so the moth flowers remain open till late at night and close till at least six in the evening.

A FLOWER THAT REMAINS OPEN ALL DAY AND ALL NIGHT

The honeysuckle is a flower that makes use of bees, butterflies and moths, so its flowers remain open all day and night. Many plants have their pollen carried by some special insect and no other, so they have learned to keep their flowers open only during the hours in which that insect is at work.

The question of the effect of light on the opening of flowers brings us back, for a few moments, to the question of dwelling-places, because we shall find that the amount of light in different places has played a large part in their choice by the plants that grow there. If we walk through a pine-forest we shall be struck by the small number of plants we find there. The greater part of it is carpeted with a deep layer of dead pine-leaves, with here and there rounded cushions of a silvery-green moss. There are two reasons for this: one is that this leaf carpet is rather dry, but the chief reason is that the leafy twigs at the top of the trees form a roof that shuts out much of the light in both winter and summer, and few plants can grow in the dim light that comes through.

A beech-wood, in which the leafy branches come lower down the trunks of the trees, is also rather dim in summer; but in winter and spring, when there are no leaves, the light is strong, and plants can do well in it so long as they get their year's work all done before the summer comes. This means that the plants living there have had to learn to get their flowering over in the spring.

WHY THE BEECH-WOOD HAS FEWER FLOWERS THAN THE OAK-WOOD

Spring is the time to see the entire floor of the beech-wood carpeted with such flowers as wood anemones, and the one woodruff, violets—not in ones and twos, but in countless myriads. In summer-time their leaves have mostly disappeared and only their ripe seed-vessels are to be seen, among some later plants that like the dimmer light.

In summer we shall find very few plants in flower in the beech-wood, and those that are there are plants that live chiefly upon the decaying beech-leaves, and so require less light. The false beech-drops is one of these, and it gets all it wants from these leaves; therefore, it does without leaves of its own or any green parts. Where little light comes sideways under the branches, another kind of beech-drops, living on beech roots, is found, together with the sanicle, that lays its leaves flat on the bare ground to get all the light it can.

In oak-woods, which are also on moister soil, the light is stronger because, owing to the way in which the sides of the oak-leaves are cut, a good deal more light finds its way between the leaves and branches of the trees. So we find many more wild flowers—and with them ferns—in the oak-wood than in the beech-wood. But whether in oak-wood or beech-wood, or even under the shade of hedges in the lanes, the greater number of the plants have to get their work done in spring, before the thick growth of leaves overhead shuts out the light and causes them to rest.

WHY THE FLOWERS OF SPRING ARE FOUND BENEATH TREES AND BUSHES

That is why some of them appear to be in such a hurry to pop up their heads as soon as the frosts have gone, and why they have disappeared altogether from sight before the wild roses are out. If we think of any wild flower of spring, and the place where it grows, we shall almost always find that the place is overshaded by the trees and bushes when they are covered with leaves, or by the summer-flowering plants of taller and coarser growths.

Long, long ago, some of the plants with the smallest flowers must have found out that, with bigger and higher flowers around them, they were in danger of being overlooked by the insects. It was not to their interests to make their flowers large, because they were already fitted for the small beetles and flies that did the work of carrying their pollen for them. So they hit upon the good idea of bringing a large number of their tiny flowers together. You will find this idea carried out by such plants as Jack-by-the-hedge, the bedstraws, woodruff, and others. Then plants like the parsley, carrot, parsnip, hogweed, and a host of others, arranged their tiny white or yellow flowers each on a little footstalk, but made a score or two of these footstalks start off from the tops of a tall stem, so that they looked like the ribs of an umbrella when the wind has blown it inside out. On that plan all the tiny little flowers came close together in a flat bouquet, and, of course, were then seen as easily from a distance as any large flower.

HOW THE PLANTS WITH LITTLE FLOWERS IMPROVE THEIR BLOSSOMS

The elder-tree and the wayfaring-tree followed a similar plan, and made huge flat bunches of their small white flowers. But the guelder rose improved upon the plan. It seems to have said: "We can make our bunches larger still, if the outer row will agree to give up their stamens and pistils, and put all their strength into making themselves as big as they can." So the outer flowers, though they wanted to make seeds as well as the others, agreed to give up their own wishes for the good of their race, and to-day, if we look at a bunch of these flowers, we shall find that the outer blossoms are twice the size of the others, but they have not a stamen or a pistil among them.

We do not know that plants copy each other, and try to "go one better," as boys and girls and men and women do; but if we were telling a fairy story about the flowers, we should feel warranted in making the dandelion say: "I know a better plan than that. What a waste to have all those short footstalks to your flowers! Build a platform at the top of your flower-stem, and on that pack a couple of hundred flowers as close as they will go." What we call a dandelion flower is really two hundred flowers, as you can see by pulling one of the golden flower-heads to pieces.

THE DAISY THAT PACKS ITS WHITE AND YELLOW FLOWERS ON A PLATFORM

Then, in our fairy tale, we could make the daisy say that it had a better plan even than that of the dandelion. "I shall pack my flowers together as she has done, but I will make mine brighter by getting the outer row to give up their stamens and put their strength into making long white ribbons to stick out all round, and set off the yellow flowers in the middle. They need not give up their hope of seeds; they can still have their pistils, and the insects will bring enough pollen for them as well as for the yellow flowers." If we pick a daisy head and compare it with a dandelion head, we shall see just this difference between them. Thistle and sunflower, tansy and oxeye, coltsfoot and ragwort, hawkweed and chicory, have all heads of closely packed flowers, and they look as though some had copied the dandelion, and others the daisy.

When we are out of doors, in the garden or the fields, we must look at all the kinds of flowers we can find, and must take note of their shapes and colors, and see where they grow, and what kinds of insects are settling upon them. Then we shall become interested in all the flowers and learn to love them.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 4133.

The inside of a large rock-salt mine at Northwich, in Cheshire, illuminated by electric light.

WHERE DOES SALT COME FROM?

CONTINUED FROM 3911

THIS question may mean various things. Most of that which we call earth and rock consists of salts of different kinds, especially salts of such metals as calcium, aluminium, sodium, and potassium. These salts were formed ages ago by the burning or combining of these elements with oxygen and others.

But when we speak of "salt" we usually mean common salt, which chemists call sodium chloride, and which is a compound of the metal sodium with the non-metal chlorine. Sodium and chlorine have a very strong attraction for each other, and the salt in earth and water must have been formed almost as soon as any natural compound.

Salt is extremely soluble—that is, melt-able—in water; and so the greater part of the world's salt is to be found in the sea. But great deposits of salt, called rock-salt, are also to be found on dry land. These have been formed by evaporation of salt water at some time when the sea was retreating from what is now dry land. What happened was that the sun sucked up the water of the sea into the air, but the salt which men now dig up out of the salt-mines was left behind.

WHAT IS THE CAUSE OF QUICKSANDS?

Quick is really an extremely old word which means living, or moving. These words, living and moving, were thought to mean practically the same thing long ago. A quicksand is a bank of sand in water; perhaps in the sea, or a lake, or a river, or we may even meet a quicksand when we dig in the earth. The sand moves with the water which is around or in it, and thus a person or a boat that is caught in such a sand may be gradually drawn down into it, as the water, and some of the sand with it, sinks.

The famous Goodwin Sands, off the English coast, were once an island. They may be quite firm and dry in parts for hours, but when covered by the sea they shift and become quicksands. In this state they are dangerous to vessels that are caught upon them. The weight of the moving sand is tremendous and irresistible. We must not think of it as sticky. It is the weight and the movement that give it its terrible power. Some 200 years ago thirteen warships were lost in a night by the power of these treacherous quicksands.

WHAT IS THE PULSE?

Most of us have seen the doctor place his fingers on a wrist, and have heard someone say that he was feeling the pulse. Perhaps when he has gone we have tried ourselves to see if we could feel anything particular there, but unless we know exactly where to feel we may not have discovered it.

If, however, we hit upon the exact spot we should feel something throbbing just underneath the skin, just a little tube expanding and contracting seventy or eighty times a minute.

As a matter of fact, that is just what the pulse is, and that is what happens. It is a wave of blood which is being sent along an artery by the force of the beating of the heart, and as the wave is confined inside this vessel or artery, which was already full of blood, the artery has to dilate or expand in order to receive the blood which is being pumped into it. Each time this happens we feel the throb, so that by feeling our pulse, and counting how often it beats or expands in a minute, the doctor can find out how often our heart is beating in the same time, because each throb of the pulse corresponds to a beat of the heart. We should understand, however, that the pulsating movement is not only to be found at the wrist; it occurs in every artery all over the body.

HOW CAN DOCTORS TELL OUR TEMPERATURE BY FEELING OUR PULSE?

The rate at which the pulse beats and the height of the temperature in the body have a distinct connection with each other, and go more or less together, so that when the doctor counts the pulse rate, and finds that it is just the rate it should be, he expects also to find the temperature quite usual. If, however, he finds that the pulse is twice as rapid as usual, he will also probably find that the temperature is much higher than normal, because the thing that causes the one to become rapid causes the other to go up. Thus, in all cases of fever, where there is some poisonous substance in the body, this substance causes the heart to beat quickly, and the pulse to become rapid, and it also causes a disturbance in that part of the brain controlling the temperature, so that both the pulse and the temperature are thrown out of gear.

WHY ARE SOME DISEASES INFECTIOUS AND NOT OTHERS?

If we had asked this question a hundred years ago, not even the wisest men could have answered it; but we know now that what we call infection is due to the presence of a vast number of very tiny living cells called germs, or microbes, or bacteria. These little creatures are so small that it requires very high magnifying powers in a microscope to see them, but it is by their action on the living tissues of plants and animals that many diseases are produced. Some germs are so small, and so light, that they can be carried about in the air and breathed out from our lungs, so that they may contaminate the atmosphere or our food, and so spread disease wherever they go. That is what is meant by carrying infection. The germs which cause typhoid fever or diphtheria often get into a milk supply or a water supply, and so cause an epidemic amongst all the people who use that source of water or milk.

There are many diseases which are not infectious, because they are not caused by these germs. For instance, many diseases are due to various forms of violence and pressure. This may be caused by lack of blood, or by blood being stopped from circulating properly. Still other diseases are due to various chemical substances which act as poisons upon the tissues of the body, while others are the results of extremes of heat and cold.

But all these concern only the individual to which they apply at the time, and are not capable of being transmitted to somebody else, as are the diseases caused by living creatures.

WHAT CAUSES CRAMP?

Cramp is really a spasm or contraction of a whole limb, or sometimes only of one or two muscles in a limb, or in the body. It may be very painful, or may be present along with numbness. We have, perhaps, often felt a sudden pain in playing some game or other when we are seized with cramp in a muscle, and this pain has, perhaps, passed off after a little vigorous rubbing. It may also be caused by over-exertion and severe cold, and is probably due to some complicated change occurring in the muscle itself.

A sharp rubbing over the surface of the muscle will usually put it right; but if we should happen to be seized with cramp when swimming, we can easily understand that it is very dangerous, because we must get to land before the cramp can be treated, and the fact that we have been seized with cramp might prevent us doing so. This is one of the reasons why it is dangerous to stay too long in cold water when bathing, or to go beyond our depth.

WHY DOES MANURE MAKE PLANTS GROW FASTER?

Do we know what growing is? It is a very wonderful and complicated process which takes place in both plants and animals, and depends upon proper kinds of food, and sufficient quantities of it, being supplied to these living things. If plants are neglected, or if children are half-starved, they grow up puny and weak and ill-formed, and the way to prevent that is to supply them with plenty of good food and fresh air. But, in addition, every kind of living tissue has a special kind of food which suits it better than anything else, and the more it gets of this kind of food the more perfectly it grows. What we usually call manure is more or less decayed stuff—the bodies of other plants or other animals that have died.

This is just the food which is more nutritious than any other for plants and crops, so when the gardener or the farmer wants to grow his plants or his crops as quickly as possible, and to get the best he can, he finds out what kind of foods suit them best, and these he gives them in the form of manure. Nowadays there are many kinds of specially prepared substances which act in this way, and scientific men, by discovering these special foods, have shown us how to grow plants and crops in soils in which they would not grow before.

WHY DOES A TRAIN NOT RUN OFF THE LINES WHEN ROUNDING CURVES?

This is a very wise question, because it assumes the truth of Newton's first law of motion. That law says that a moving thing tends to go on moving in the same direction, and, indeed, must do so, unless something alters it. It follows from this law that the train going round a curve must run off the lines unless some forces are brought to bear that will alter its direction.

As we know, trains can be made to run round curves. We simply have to find out what the arrangements are which interfere with the tendency to move straight. We first think of the flanges on the wheels, but these are of small importance. If there were nothing else, the train would ride off the rails in a moment. The next point is the way in which the wheels are cut, as we can see on page 920 ; and, finally, there is a most important arrangement by which the outer rail on a curve is raised. When the railway is made, men have to calculate how sharp the curve is, at what rate trains are permitted to go round it, and then they have to raise the outer rail in proportion. We see just the same thing on a cycle-racing track, which is banked at the curves. The resistance offered by having to go uphill, so to speak, keeps the train in the path we desire. We are opposing the force of gravity to the tendency of the train to move straight on.

HOW IS IT THAT THE FOG DEADENS SOUND?

The intensity of sound varies according to the law of physics, which is equally true for light, for heat, and for gravitation, as well as sound. This law states that the intensity varies inversely according to the distance, so that the further off the sound is the less audible it is; but that is not the only thing which causes the intensity of a sound to vary. The second condition is the density of the medium through which the sound is transmitted. For instance, no doubt we have noticed how clearly we can hear sounds on a frosty night, and the reason is that the air is more dense and transmits the sound more readily.

On the other hand, if a gun is fired on a mountain of a very great height, where the air is extremely rarefied, the sound is no greater than that of a toy pistol under ordinary circumstances. Now, in the case of a fog, the solid particles in the air may affect the transmission of the waves of sound, but the main thing which influences the intensity of any sound is the density of the atmosphere.

WHAT ARE CORNS?

A corn is a hard growth which occurs on the toes or some other part of the feet, and is generally the result of wearing a shoe too small for the foot. The corn itself is composed of the outer part of the skin, and the overgrowth of this skin in a lump, which produces the corn, is caused by the pressure of the shoe at the spot. But the corn would not result unless the pressure was taken off at intervals, and this, of course, is done when we take the shoe off. If the pressure were kept applied to this spot all the time continuously, the skin, instead of overgrowing at that point, would waste away. It was once the custom in China to place a very tight bandage round the feet of the ladies, and this was kept on always, with the result that the feet did not grow to their proper size. So that the result of the pressure on the skin depends entirely upon whether it is continuous, and whether it is severe. The overgrowth of the skin is due to the irritation produced by the pressure.

WHAT ARE FRECKLES?

What we usually speak of as freckles are spots of a yellowish-brown color which are seen on the skin of some people, especially after they have been exposed to strong sunshine for some time. They occur chiefly on the face, on the neck, and on the hands, because those are the parts of the skin unprotected by clothes. Some people are much more liable than others to have this coloring produced, and in some it disappears quite quickly, while in others it lasts a long time.

In all these cases the freckles are the result of the action of the sun on certain cells of the skin, which causes these cells to produce coloring matter, or pigment, which remains there for a certain time. There are cases, however, in which freckles do not appear to be caused by very hot sunshine or exposure, but which come naturally, just as the color of the skin itself is either fair or dark, according to the tendency inherited by the individual.

WHY DOES ANYTHING PUT ABOVE A FLAME ATTRACT IT?

The direction a flame takes depends entirely on the currents of the air moving around it. If the flame is burning in a still atmosphere it points straight upwards, because the hot air above it is lighter than the colder air below, and so tends to rise and make a draught upwards in the direction of the flame which has to be filled up by the cold air beneath. Now, if we hold, say, a key above such a flame, this process is made more marked because the hot air is turned aside by the key, and so makes a stronger draught, the current of which points to the centre of the key. The air at that spot is hotter than it is anywhere else, and rises very rapidly, and the hotter it is the stronger is the draught in that direction. Therefore, the point of the flame is attracted to that spot.

WHY DOES NOT THE WATER FALL OUT OF A QUICKLY REVOLVING PAIL?

We must remember that every substance, whether it be a solid or liquid, tends to remain in the same position unless some force is applied to it to move it. The force of gravity keeps the water in the pail when the pail is at rest, and attracts both the pail and the water to the earth. When we swing the pail over our heads, gravity would cause the water to fall out if we held the pail still, but by keeping it moving we bring other forces into action which act in other directions, and tend to make the water press against the sides of the pail.

If the water could get out it would not fall straight down to the earth, but would go on some distance in the direction in which the pail was moving at the moment, and would gradually come to the earth. So that the water stays in the pail as the result of the several different forces acting upon it while it is being swung quickly round and round.

WHY DOES A BEE DIE WHEN ITS STING COMES OUT?

What we call the sting of a bee is not really meant to be used as a sting. It really exists to help the bee lay its eggs, and when the bee uses the sting, it is generally roughly torn away from the bee's body, causing damage which is usually fatal. This is a very curious case where part of an animal's body has had its real purpose changed; but the change has required a heavy cost, for the sting cannot be used except at the risk of the bee's life.

This means that to use its sting is an act of suicide on the part of the bee, and if a bee lived for itself, this would indeed be a foolish means of protection. But every bee lives for the hive, and the real use of the sting is not to attack us, for instance, when we hit at a bee with a handkerchief, but to protect the beehive from its enemies. The bee's sting is not a weapon of offence, but of defence —not self-defence, but hive-defence. It is used only under provocation, and only for the sake of others and the future of the bee race. The bees that sting do not themselves lay eggs, and so it is that they are able to turn this part of their body to quite a new and utterly unselfish purpose.

IS IT TRUE THAT THERE IS THE SIGN OF A LOST EYE ON OUR BRAIN?

It is quite true that there is a part of the brain which is supposed by very learned men, who have studied the brains of all kinds of animals, to represent an eye which occupied the position of the middle line of the head right in the centre. This structure is still present in animals to-day, and even in man himself, although it no longer has any function belonging to sight. But, curiously enough, there is still existing in the far-off country of New Zealand a lizard whose proper name is sphenodon, in which this central eye is so near the surface that it can still be affected by the rays of light.

This curious creature seems to be the only remaining animal in the world in which this eye exists. It is thought, therefore, that some animals had originally one eye in the middle, and that as they evolved into more complex creatures the one eye has become separated into two, a right and a left eye.

WHY CAN ONE HEAR A WHISPER ACROSS THE DOME OF THE CAPITOL?

Perhaps we have often noticed, when we have been in different buildings listening to somebody speaking, either at a lecture or in a church, that it is sometimes much easier to hear the speaker than at other times, and that this does not seem to depend upon the size of the building. In fact, in some very large buildings it is very easy to hear perfectly, and in some quite small buildings it is extremely difficult.

It all depends upon the shape and arrangement of the walls in relation to the sound-waves which have to come to our ears before we can hear anything. Now, the construction of the dome of the Capitol at Washington is such that the sound-waves which are set up even by a whisper are so controlled that a person standing at a distance can hear them distinctly. It is a mere matter of directing and controlling waves of sound so that they are not dispersed, and that is why we hear them.

DO WE ALWAYS WAKE WHEN WE HAVE HAD AS MUCH SLEEP AS WE NEED?

This is an extremely important question, because the answer to it must decide one of the most essential points in taking care of children. At one time, the view used to be held that children were naturally lazy and naughty, and that Nature in general had done things so badly that, to give the children a chance, it was necessary for grown-up people to interfere with everything that the little ones inclined to do. On this theory, the children were awakened at a fixed hour, as if all children required the same amount of sleep, as if the same child always required the same amount of sleep every night, and as if all sleep were of the same quality, and so could be measured by hours. This was all wrong.

People who really know—because they have given their lives to studying the subject—are certain that a child will wake when its brain has had all the sleep it needs. The waking is the proper fruit of the sleep. A child could not sleep too long, because directly sleep has done its work the brain must wake; that is what sleep is for. On the other hand, the slightest noise may awaken children before they have had their sleep out, and then grown-up people call them cross and naughty, and say they have got out of bed the wrong side, and all that sort of nonsense. It is only a few children that get all the sleep that Nature asks for them, and it is believed that a large number of these children afterwards become the leaders of their generation.

WHAT MAKES NOISE, AND CAN IT BE HEARD WHERE THERE IS NO AIR?

What we call noise is all those kinds of sound which have no musical quality. They are not musical because they consist of waves in the air which are not regular, but which just come "anyhow" against the ear.

We usually speak of sound as a wave in the air, because that is what it generally is. Certainly it cannot be heard where there is no air, if by "no air" we mean a vacuum—a space from which the air has been removed as far as possible. But the waves that make sound can be carried through other gases besides those that make up air, or through liquids or solids. Sound travels quite readily, for instance, through water. We know only too well that it travels through solids, for closed windows do not exclude the street sounds from our ears, though they make the sounds less. This means that the waves movement of the air outside the window is communicated to the glass, and then by the glass to the air inside the room. The glass cuts off some of the sound, because a certain amount of power is lost in transferring the wave from one medium, as we say, to the other.

Though noise and sound in general can be conveyed through any kind of matter, whether solid, liquid, or gaseous, what we call the ether cannot convey sound. Thus there can be no sound in the depths of space, and not the greatest noise made in the sun could ever reach the earth. On the other hand, *nothing but* the ether can convey light.

HAVE THINGS ANY COLOR AT NIGHT?

Of course a thing has color at night, or at any other time if it gives out color of its own, as a fire or a gas-jet does. The things that give out light of their own we call luminous. The question really is: Have things that are not luminous any color at night? Now, when we say color we mean colored light, light of such a kind that it gives us a feeling which we call color. If there is no light there is no color. Even a non-luminous thing may have color at night if there is light in the room. So now we can put the question in the exact and proper way—Have non-luminous things any color in the dark?

The answer to that question is: Certainly not. An orange is yellow because when yellow light, or white light containing yellow light, is thrown upon it, it has the power of throwing the yellow light back to our eyes, and so we call it yellow. If no light falls upon it, it can throw no light back, as, unlike the fire, it produces no light of its own; and so, of course, it has no color in the dark, nor has anything else that does not produce light of its own; and if it did produce light it would not be in the dark. In a word, what we call color is a kind of light, and where there is no light there can be no color.

WHY DOES THUNDER TURN MILK SOUR?

Thunder, we know, is a disturbance of the air which we hear as noise, and which is made by the passage of electricity, which we call lightning, through the air. This noise in the air does not turn milk sour, so directly we think what we really mean by thunder, we see that the question has not been put quite in the right way. All the same, we know that, at times when it thunders, milk very quickly turns sour; and though we see, of course, that the thunder does not turn the milk sour, we must find out what it is that does. The answer is that there is something in the state of the air in thundery weather which affects the milk, and this it does whether we happen to hear thunder or not. The air in thundery weather is charged with electricity; that is a very vague phrase, but we really cannot make it more precise yet. It is also, as a rule, very moist and very warm. These three conditions, especially the presence of the electricity and the warmth, greatly favor what goes on when milk turns sour. And that is why milk keeps fresh such a short time in thundery weather.

OF WHAT ARE OUR EYES MADE?

In another part of this book we learn how our eyes are built, but this question about the stuff of which they are built is well worth answering. If we could take an eye to pieces, and sort out all the different things of which it is made, we should find that, like the body in general, a great part of it was made of water, certainly not less than four-fifths of it. Besides water we should find the various elements that go to make up living matter, or protoplasm. In the eye we find many kinds of cells which consist of protoplasm, and others, such as the cells of the lens of the eye,which, though they were made by protoplasm, consist of something else quite peculiar to themselves.

But in the curtain of the eye we should find the protoplasm mainly in the form of nerve-cells, and if we trace back the development of the eye, we find that the most important part of it—the part which really makes it an eye—has grown out from the brain, and is really a little part of the brain pushed forward. Part of the front of the eye is really skin that has been changed for the purpose of an eye, but the part that really makes the eye an eye is just as certainly part of the brain, when we come to know its history, as the rest of the eye is part of the skin.

DOES IRON OR STEEL BECOME TIRED?

When we speak of anything growing tired, we naturally think of a living creature, such as ourselves. We know that we, when we are not tired, can do certain things, but when we are tired, some change has occurred inside our bodies that prevents us from doing those things.

The proper word for this state is fatigue. Now, if we take a piece of steel like a razor, which can do certain things, such as cut very sharply, and if we overwork it—as we should say if we were talking of a horse—we may find that it will not cut as it used to do, however carefully we prepare its edge. Something has happened to it which prevents it from doing what it was able to do before. We are quite entitled to call this "getting tired," as we do in the very similar case of ourselves.

The fatigue of metals, as it is called, is now a well-known fact, to the study of which at least one well-known student has devoted much of his life. It may be of very great importance at times in the use of tools and machinery, as anyone may guess who finds that his razor needs a rest. But the fatigue of metals is also very interesting in another way, especially when we begin to learn how it depends upon changes in the way in which the molecules of the steel are joined to each other. For it may be that, if we could learn fully about the causes of tiredness and the cures of tiredness in razors, and things like that, we might better understand fatigue in ourselves, how to prevent it and how to cure it.

WHY ARE THERE TWO TIDES A DAY?

This is a very puzzling question, to which very few people know the answer. The earth only spins round once in a day, and the moon pulls the water up towards itself on the side of the earth next the moon, making what we call high tide. Anyone would think, then, that there must be only one high tide a day. But the moon not only pulls up and heaps up toward itself the water on the side of the earth that is next it at any given moment; it also pulls the earth towards itself away from the water on the other side of the earth, the side farthest from the moon.

The moon attracts the earth more powerfully than the water on the far side of the earth, since that water is farther away from the moon. So when it is high tide anywhere, it is also high tide on the other side of the earth. This must mean that we get two high tides in twenty-four hours.

The first of them, perhaps, is due to the moon heaping up the water on the side of the earth next it—the side of the earth where we are. But twelve hours later the earth has spun round so that we are on the side away from the moon, and now the moon is pulling the earth towards itself more strongly than it is pulling the water, so the water where we are is heaped up again, and that, of course, makes the *second* high tide we have in the twenty-four hours.

DID MAN ALWAYS TALK?

We can only give a *probable* answer to a question like this, for evidently we have no certain way of finding out the answer. Some people have supposed that there must have been a time when man did not talk, and so they have given a special name to men of that period. But we may be almost sure that they are wrong. The lowest kinds of human beings now living certainly talk; but they are much higher than the first men were, no doubt.

We know that the highest kinds of apes have a sort of language, and that makes it probable that the earliest men had a language too. Indeed, many people think that language, or speech, is exactly the thing that makes man, and that man, therefore, when he appeared on the earth, was able to speak, and that men have always been beings that could talk. Another way of saying this is that we could not call beings human who had not the power of speech in some form or other. Such beings could not teach one another from generation to generation as human beings do, and, in a word, they would only be animals, to say the best of them.

DID MAN ALWAYS WRITE?

Writing is a form of speech, only written instead of spoken. But it is very much more difficult to learn, as we all know; and if we think for a moment, we shall see that it must have been much more difficult to invent. Indeed, a simple kind of speech scarcely required invention at all, for it could grow out of mere noises that meant pleasure, or anger, or distress. But writing requires invention. It needs people to agree with one another that certain marks shall mean certain things; and this is true even though we know that writing grew out of simple pictures of things like the eye, or a man standing that anyone could recognize.

We do not think there can be any doubt that, just as we all can talk and understand what other people say long before we can write, so mankind could talk long before writing was invented. We have evidence of the existence of human beings who have left us rude pictures scratched on bones, for instance, but no signs at all of any kind of writing. Indeed, "man before writing" was, until lately, supposed to have lived in Europe not many thousands of years ago; and though we now know that writing goes back much farther than we used to think, we can compute fairly well about the time that it was invented. It was easily the most wonderful invention of all time.

WHY DOES HEAT MAKE PAPER CURL UP?

There is a certain amount of water in all ordinary things. The amount of water in a sheet of paper makes it heavy. We know how heavy and limp a piece of quite damp paper is. If we heat the paper, we drive the water away, because we change it into a gas that passes off into the air. Spaces in the paper that were filled with water before are now filled with air, which is very much lighter. If there are any forces in the paper tending to make it curl up, they are now free to act, for they have not to lift the weight of the water that was previously in the paper.

Also, we must remember that paper, like almost everything else, shrinks, or contracts, when it is cooled, and expands, or takes up more room, when it is heated. If the change in temperature occurs at exactly the same rate in every part of a thing, then, as its size alters, its shape will not alter; but if one side of a thing gets hot or cold at a slightly different rate from the other side of it, then its shape will change, and if it is a thin, flat thing we shall notice the change by finding it curl up.

WHY DO THE WAVES CURL OVER AND BREAK?

If the question had been "Why is a man who steps off a moving train likely to fall on his nose?" the answer would have been just the same as to this question. The man's body is all moving as he steps off the train. But when his feet touch the platform, their motion is stopped—unless he is careful and at once runs quickly enough. The rest of his body goes on moving, however, and as his feet are left behind, he will topple over and fall, even if he does not break up like the waves. In the same way, when the wave reaches the shore, its feet, so to speak, are caught and held back by rubbing against the sand or shingle; but the rest of the wave moves on, and so it topples over and breaks.

WHY DO TREES GROW TO A CERTAIN HEIGHT AND THEN STOP?

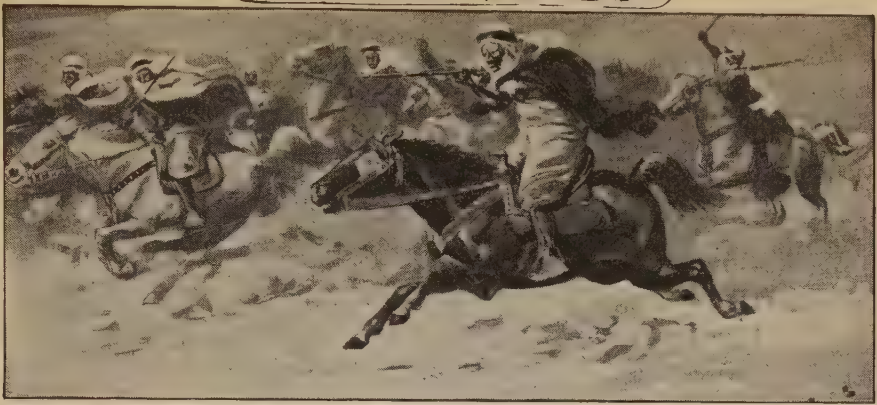
Well, we might ask the same question of men, or horses, or birds, or any other living creature, as of trees. The reason is that the growth of living things is not like the growth of a snowball or a crystal. Such things simply go on growing the more "food" they get. There is nothing inside them limiting their growth. But every living creature has the marks within it of something that has a purpose—which snowballs and crystals have not—and that purpose is simply *to live.* In general we may say that living things grow to the size which suits them best, and so favors their life best; when that is done, they stop growing, and merely maintain themselves as long as they can. We have to think of every living creature as if it had a plan, a definite course of action which it had resolved upon, and which it will pursue if the conditions outside allow it to do so. It grows to the shape and the size to which it is *meant* to grow, and then no powers on earth, no amount of food and air and light, will make it grow even the least little bit more.

WHAT MAKES A LEAD PENCIL WRITE?

The ancients, and modern engravers also, used pencils made of pure lead and pure silver. Nearly all metals are too hard to rub away against paper sufficiently for us to notice any marks; and there are few metals whose color would show well against paper. A "lead" pencil is made of a vast number of tiny crystals of carbon. This form of carbon is called graphite, from the Greek word for writing. The crystals are small, and of such a shape that they can easily be rubbed away from each other.

If there were no such thing as friction, the pencil would not write. The power of friction, or rubbing, depends upon the force with which the rubbing surfaces are pressed against each other; so the firmer and harder we press with our pencil, the more graphite is rubbed down by friction on to the page to record the track of our "lead" pencil.

THE NEXT QUESTIONS ARE ON PAGE 4109.



THE ARAB PATRIOT OF ALGERIA

CONTINUED FROM 3821

ABD-EL-KADER, whose name means "servant of the mighty God," was an Arab of Algeria, born in 1807, and a man of remarkable character. With a fine and graceful figure, and a body of great strength and endurance, he was unsurpassed in courage, profoundly learned, and had high standards of duty and honor. He had, too, a powerful influence for good over all with whom he came in contact. When a young man of twenty-six, he left his life of study and religious meditation to lead his people, as Sultan, against the French invaders, and for fourteen years he tried to free Algeria from the foreign yoke, and form a great Arab nation.

Alone, or with a few horsemen, he would appear in a remote part of the Atlas Mountains, or in the Sahara, and rally thousands to him. When the French anticipated an attack in their rear, he would suddenly appear in front, as we see in the picture. He could shoot accurately while standing in the saddle, with his black Arab horse speeding like lightning; or he would enter a town and harangue the townsfolk into defence of their country and religion. He treated his prisoners as guests, sending them money, clothes, and food. Formerly, Arabs had killed their prisoners. Some women were once captured and brought to him, and as he set them free he exclaimed in anger: "Lions attack strong animals; jackals fall upon the weak."

Often Abd-el-Kader and his brave followers had insufficient food, or galloped for days together over the desert sands. Once when they were living on acorns, a stray sheep was brought to him. "Take it to my starving soldiers," said the leader.

But the resources of France were limitless, and though many armies were sent in vain, 100,000 disciplined troops in the end overcame the little remnant of the Arab forces. Even then, when Abd-el-Kader wandered with hardly a follower, such was the terror of his name that the French had to keep a large army on foot.

Not until his cause was utterly hopeless, in 1847, did this brave man surrender, on condition that he and his family should be free to live in Alexandria or St. Jean d'Acre. That promise was not fulfilled, for he was kept a patient prisoner in France for many years. They offered him wealth, a château, a guard of honor; but he indignantly refused them, demanding that France should redeem her pledge. In 1852 Louis Napoleon saw that this was done, and he was set free.

In 1860 a Turkish mob rose against the Christians of Damascus, where Abd-el-Kader was then living. With some Algerian soldiers he saved the lives of 15,000 people, and from that time honors and distinctions were heaped upon him, until his death, in 1883.

THE BOY WHO TOOK A MAN'S PLACE

ABOUT 150 years ago a young boy, who was ready to make a start in life, was apprenticed by his friends to the captain of a Scottish coasting vessel, and although in those days the seaman's life was a very hard and perilous one, the boy had sufficient liking for the sea to throw himself with all his heart into his duties.

But storms and tempests were not the only risks to which the seamen of those days were subjected. There was the press-gang, which might seize on a man and put him on a ship that was leaving England perhaps for years.

Life in the Navy was so full of brutalities and hardships that it was most unattractive, and sufficient men could not be obtained by ordinary recruiting to man the vessels of war. The press-gang was therefore set to work, and bands of ruffians used to raid a vessel or a town, seize any likely man, and carry him off to a warship, quite regardless of the fact that he might have a wife and children or an aged mother dependent upon him.

The coasting vessel on which the young apprentice sailed was visited by the press-gang in this way, and every man on board, with the exception of himself and the captain, was seized for war service. The mate had a wife and young family, and his distress at being dragged away, perhaps never again to see them, was so pathetic that the apprentice felt the greatest sympathy for him, and offered his own services if the mate could be released.

The head of the press-gang, an officer of the king, readily fell in with the suggestion, saying: "Ay, my lad. I would sooner, any day, have a likely boy with some spirit in him than a blubbery man. Come along with me."

The boy went, and the circumstances in which his services had been obtained were related to the commander of the warship, who was so pleased with the spirit and kindness of the lad that he promoted him to be a midshipman at once. The lad did his work splendidly, and took the greatest pains to learn his duties, so that promotion followed promotion in rapid succession.

Later he obtained command of a small vessel of his own, and was soon promoted to a larger one, and at last that ambition of every keen midshipman—to be an admiral of the British Navy—was fulfilled, and the young apprentice, who had sacrificed his own interests and comfort for the sake of the mate and his family, became Vice-Admiral Campbell, a name greatly honored in the annals of the British Navy. He died in the year 1790.

A BAND OF NOBLE MEN

WHEN Napoleon was forced to retreat from Moscow because the city was in flames, he fled with the remnants of his army across the bleak, snow-covered plains of Russia, with the enemy's army in pursuit. That was in the severe winter of 1812. It was a terrible march. The hungry, sleepy, frost-bitten men—French, Italians, Germans, and Poles, soldiers from the countries subjugated by the ambitious Napoleon—were scarcely able to crawl along; yet they were urged forward by dread of the Cossacks in pursuit.

Among the Germans was Prince Emilius of Hesse Darmstadt, heading his little band of ten, all that remained of the thousand men he had led eastwards a few weeks before. As night came on, they stumbled upon a burned hut standing out in the dark. Then the Prince Emilius, turning to his men, said: "Dear brothers, we must rest here, trusting to Heaven that, whether we wake again on earth or not, all is well if we have faithfully borne our part in the toil and suffering."

And so they lay down in the ruins of the hut, and Prince Emilius was soon dreaming happy dreams in which he saw kind faces bending over him.

At last he woke with a start, warm and rested, wondering where he was. Then he remembered the dreary march, the snow, the hunger, and the misery. He looked about the burned hut, but no one was there. Then he discovered that he had been sleeping beneath a pile of garments which he recognized as those of his soldiers. And as the daylight increased, he saw that the doorway was blocked up with the bodies of his noble men, who to save his life had sacrificed their own.

THE GIRL WHO SOLD HER HAIR

AT the time when Napoleon was trying to conquer all Europe, and state after state was falling a prey to his grasping ambition, Silesia, a German territory, was doing her best to beat back his invading armies. Everyone in that freedom-loving state was wrought up to a passion of ardent patriotism in the terrible year of 1813, giving all he could to the cost of equipping an army for defence.

A Silesian girl had no fortune to put at the service of her country. Her small possessions were of hardly any value, yet she burned with eagerness to help her countrymen in their fight against the invader.

One day the idea came to her that she might sell her thick, long hair, and so obtain some money. She accordingly set off to Breslau, where she sought out a hairdresser, and offered him her tresses. He could not understand why she should want to part with her beautiful hair, so she had to tell him the reason. Then he agreed to cut off her hair, but could not afford to give more than two dollars for it. The bargain was made, the hair was cut off, and the girl returned home.

The hairdresser was so touched with this instance of self-sacrifice that he would not part with the hair in the usual way, but used it in making various ornaments such as bracelets. The story of what this Silesian maiden did for her country became known. All Silesia was proud of the act, and articles made of her hair were eagerly bought. So much were they in demand that the hairdresser reaped a golden harvest, and contributed a large sum to the state.

A PRINCE WHO GAVE UP HIS FREEDOM

IN the Middle Ages, Ceuta, which lies just opposite Gibraltar, on the northwest coast of Africa, was a hot-bed of piracy, and King João of Portugal and his sons made an expedition to it, captured it, and released the Christians imprisoned there. Eighteen years later, in 1433, King João died, and soon after two of his younger sons, Henrique and Fernando, laid siege to Tangier, a town farther along the coast.

But the Moors, with their allies, surrounded and entrapped the little army. They were unable to reach their boats, had no food, and were forced to give to the Moors a hostage for the delivery of Ceuta. Prince Fernando offered himself, and then his brother had to leave him. Their elder brother, the King of Portugal, sent a fleet to Ceuta, but nothing was done, and Prince Fernando remained a prisoner.

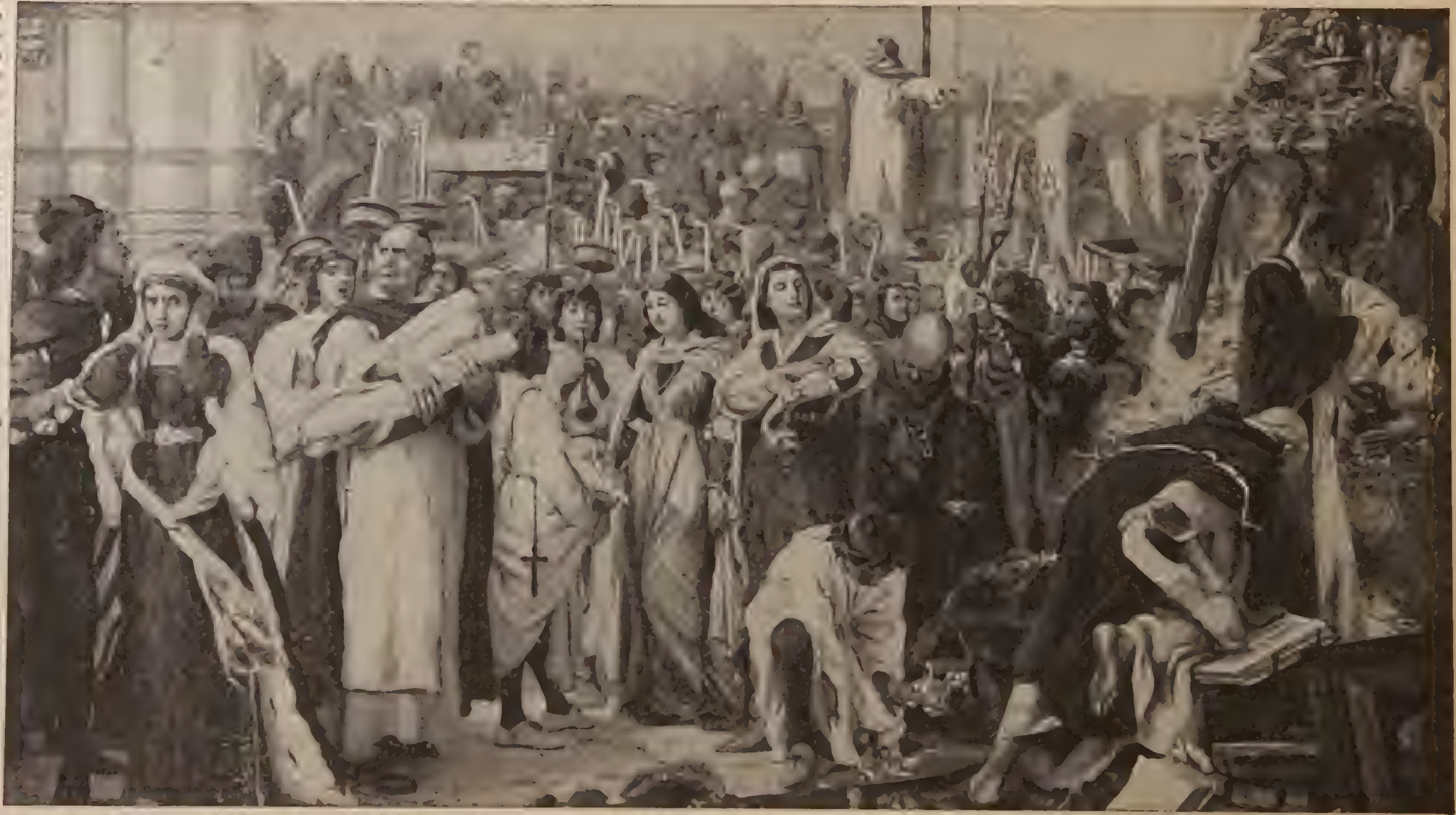
Soon the Moors were angered that no ransom was sent, and that Ceuta was not yielded to them, so in revenge they maltreated and starved the prince. Now, his mother was Philippa, the daughter of John of Gaunt of England, who had brought up her son to be a man worthy of his knighthood. So Prince Fernando bore his troubles patiently, enduring all so that Ceuta might remain in the hands of his Christian countrymen. The king, his brother, tried to raise an army to free him, but he caught the plague by which Portugal at that time was being desolated, and died from it. His little child, aged six, became king, and quarrels disturbed the land, and thus, as the years passed by, hope of release for patient Prince Fernando grew less and less.

Two kings in Spain, however, touched with admiration and pity for him, planned to attack Tangier and release him, but that only led to his being sent to the King of Fez inland. He put the prince first in a dungeon without light or ventilation, and then made him labor among Christian slaves. But Fernando was so kind to them, and behaved so nobly, that even the King of Fez expressed admiration for him.

After ten years in prison for the honor of his country, brave Prince Fernando died. The Portuguese hold his memory very dear, and call him Prince Constant. The poet Calderon, too, wrote a great play, and made him the hero of it. And though his life was seemingly offered in vain, Ceuta has ever since belonged to the Christians; for when it ceased to belong to Portugal, it passed into the possession of the Spaniards. Thus, what Prince Fernando gave his life for was really accomplished—the rule of a Christian prince at Ceuta.

THE NEXT GOLDEN DEEDS ARE ON PAGE 4089.

SAVONAROLA'S FAMOUS BONFIRE OF VANITIES IN FLORENCE



The power of Savonarola in Florence grew until it became greater than that of the rulers of Florence, and huge wooden galleries were set up in San Marco to hold the crowds that thronged it. Under his influence the people resolved to burn their vanities, and this picture by Mr. F. W. Topham shows the burning of their "vain and unholy things."

LOYOLA

ST. FRANCIS XAVIER

THOMAS A KEMPIS

ATHANASIUS

ST. DOMINIC

ST. BERNARD

ST. JEROME

SAVONAROLA

SOME FAMOUS MONKS

CONTINUED FROM 3942

ROGER BACON

THERE has always been much discussion on the subject of monks and monasteries. In our land there are fewer monasteries than in some other countries. Over here people, speaking generally, are not inclined toward the cloister so much as some other nations. It is not their way to shut themselves away from the world; they prefer a more active life. The young man takes more kindly to making steam-engines or alarm-clocks, or a fortune, than to cutting himself off from the world and devoting his whole life to contemplation or to the service of his order.

But the monk is a picturesque figure. He reminds a world too easily vulgar, too easily satisfied with the frolic of vanity fair, that life carries an immense responsibility. He is one of the texts of Christ in human form: "What shall it profit a man if he gain the whole world and lose his own soul?" There is more than one way of reading this text, but the monk is at least one rendering of it. He reminds us that, in comparison with eternity, man's life is but a shadow.

There have been bad men in monasteries as well as saints. But chiefly, perhaps, they have been filled with good, quiet, commonplace men, to whom the struggle of life presented either a dull or a terrifying aspect. Here and there the records are lighted up by daring, defiant, or revolutionary and heroic figures, who seem to snatch the falling time in which they lived from the flames of destruction, and valiantly to thrust the world forward on its march of progress. One monk, as we shall see—and he was an Englishman—was the first voice lifted up for science after a silence of fifteen centuries.

Let us begin with the most curious of all monks—and hardly meet to be called a monk—the famous Athanasius. A little man, radiant with intelligence, possessing "the face of an angel," according to Gregory, Athanasius was said to be "quick in sympathy, pleasant in conversation and still more pleasant in temper, effective alike in discourse or in action, assiduous in devotions, helpful to Christians of every class and age, a theologian with the speculative, a comforter of the afflicted, a staff of the aged, a guide of the young." At the age of thirty-three he was called to be Bishop of Alexandria.

In those days a great controversy tore the Church, and the struggle became at last "the whole world against Athanasius, and Athanasius against it." Again and again he was driven from his bishopric; again and again he returned. Once soldiers rushed in to take him at the altar. He showed no fear. This devoted son of the Church spent the periods of his exile in monasteries, and, during those times of quiet, wrote some memorable books. He was not a true monk, and was more a statesman than a priest; but his devotion to his ideas concerning Christ were of the most devout and sacred kind. We owe it to the monasteries in Upper Egypt that some of those ideas come down to us. Athanasius was born about 296 and died in 373.

HOW A CHILD'S VOICE MADE A BISHOP IN A CITY CROWD

Of all the monks who ever lived, if he can properly be called a monk at all, the strangest is St. Ambrose. At the age of thirty he was so successful as a lawyer that he was made a governor, and lived in Milan. A dispute arose between two sects of the church over the election of a bishop. There was a dispute in the church that was almost a war. Ambrose hurried to the scene, and made an earnest and eloquent appeal to the people for Christian behavior. As he ceased speaking—so says the legend—an infant's voice suddenly cried out: "Ambrose is bishop."

The crowd took up the shout. In vain did Ambrose protest that he was a bad man and not fit at all to be a bishop; in vain did he try to escape. The whole city insisted, and the lawyer and governor, selling his goods and putting by his robes of state, became a Christian bishop. The day came when he showed his spirit. The powerful Emperor Theodosius ordered a massacre and the slaughter had been carried out. Ambrose, shocked to the soul by this bloodthirsty outrage, wrote to the emperor, refusing to let him enter the church of Milan.

THE FEARLESS AMBROSE, WHO MADE AN EMPEROR DO PENANCE

The emperor replied that David had committed murder. "Imitate him in his repentance as well as his sin,'' answered the heroic bishop. For eight months the bishop kept the emperor at bay. Then, one day the emperor's courtiers came to Ambrose and announced that the emperor was coming. "I will hinder him from entering the vestibule," said Ambrose; "yet, if he will play the king, I will offer him my throat." When the emperor heard this, he said: "I will go and receive the refusal which I desire.'' But on meeting the bishop he said: "I come to offer myself to submit to whatever you may prescribe."

Ambrose then commanded him to do public penance, and in future—because his temper was ungovernable—to let thirty days run between the order for capital punishment and its execution. Ambrose was a just, fearless, and upright man, and his writings are those of a devout and fervent worshipper of God. Born about 340, Ambrose died in 397.

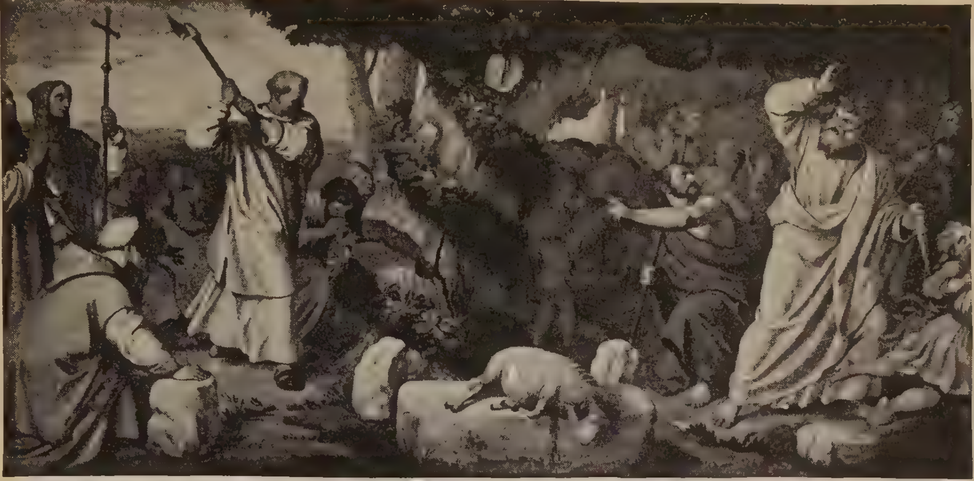
St. Jerome is interesting to us as the Latin translator of the Scriptures. He is also interesting by reason of the picture he presents to us of a man fighting what he considered a dreadful sin, namely, a love of books. Poor Jerome was a scholar. He loved old books, and he could only be happy with venerable authors full of tales of long ago. But a day came when, brought by sickness to death's door, he reflected on the next world, and came to the conclusion that pagan literature was wicked.

JEROME, THE MONK WHO LOVED BOOKS AND FLED TO THE WILDERNESS

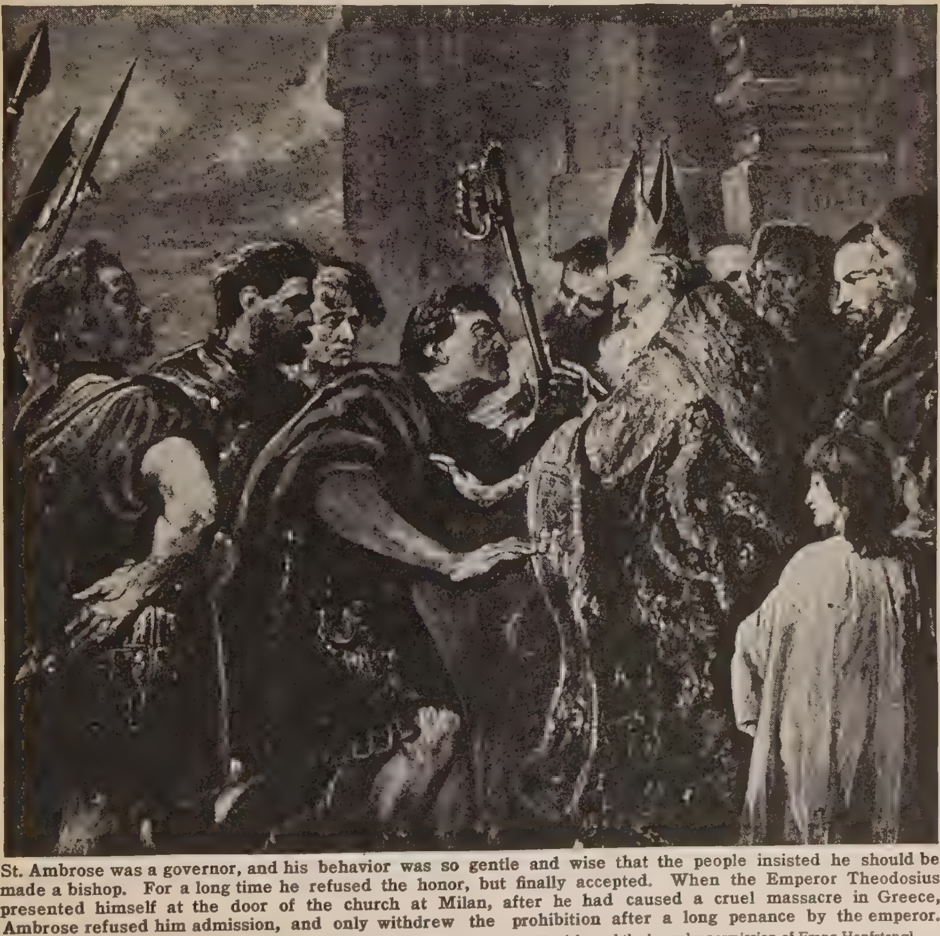
Before this time he had been a man who loved to take part in arguments about the Church; now he became a man who wanted to live the Christ-life. He became a hermit, and lived in the wilderness. But in the wilderness there were books in a monastery there, and soon he was among his temptations again; he again became mixed up in violent arguments. Called to Rome to help in a dispute, he became a great favorite with ladies, and when he set out to the Holy Land, he was followed by a train of admirers. They built three nunneries and a monastery, and Jerome settled down in this monastery at Bethlehem to translate the Old Testament from Hebrew into Latin. Jewish Rabbis came to him by night to help him in his work.

But whenever an argument broke out in Rome, off flew Jerome eagerly, for he simply could not keep himself out of an

TWO MONKS WHO FACED GREAT DANGERS



St. Boniface, an English monk who carried Christianity to the heathen nations of Germany, braved dangers in seeking to win them for the truth. To prove that their gods were no gods, he undertook to destroy the sacred oak of Geismar, and here we see him full of zeal, chopping down the tree before the heathen priests.



St. Ambrose was a governor, and his behavior was so gentle and wise that the people insisted he should be made a bishop. For a long time he refused the honor, but finally accepted. When the Emperor Theodosius presented himself at the door of the church at Milan, after he had caused a cruel massacre in Greece, Ambrose refused him admission, and only withdrew the prohibition after a long penance by the emperor.

The upper picture is reproduced by permission of Messrs Jager. & Gorgen, Munich, and the lower by permission of Franz Hanfstengl.

altercation. He was like an Irishman, always spoiling for a fight. So violent was his manner that it is said that his monastery was attacked by furious enemies. To the end of his life Jerome was a scholar and a disputant. No wilderness and no monastery could ever have held this worthy man without books. He was a good man, and deserved his sainthood. Jerome was born about 340 and died in 420.

THE ENGLISH MONK WHO TOOK CHRISTIANITY TO GERMANY

It was a monk from England who, in the eighth century, carried Christianity to Germany. His name was Winfrid, and he was born probably at Kirton or Crediton, in Devonshire, the son of a West Saxon chieftain. As a boy he was sent to a monastery school in Exeter, and became an excellent scholar and a noted preacher. After some years he went to Rome, and from there was sent by the Pope as a missionary to the Germans.

We get a quaint picture of the period in the scene which took place between Boniface and the heathen of Germany to decide between God and Woden. Boniface undertook to chop down their sacred oak. The heathen, thinking he would infallibly be struck down by their wrathful god, stood by to watch his destruction. The oak fell with a crash; Boniface did not. Whereupon the heathen embraced Christianity, and out of the oak Boniface built an oratory to St. Peter.

But alas for poor Boniface! He was himself destined not to end his days in peace. After a life of the most manifold and successful labors; after having converted thousands to Christianity, set up monasteries, built churches, and it is said anointed Pippin king of France in the name of the Pope, Boniface was attacked by a body of pagans, and, offering no resistance to their onslaught, won the glorious crown of martyrdom. The poor old man, frail and delicate, fell before the clubs of savage robbers, and died with his relics clasped in his hand. His life was one of the most useful, hazardous, and courageous ever lived by man, and England may be proud of her missionary. Boniface died in 755.

ST. BERNARD, WHO DENIED HIMSELF PLEASURE AND FOOD AND FRIENDSHIP

One of the most attractive monks in history is St. Bernard, called the "last of the fathers," so simple was he, so full of faith, so quiet of soul, so touched by the Spirit of Jesus. He was the son of a French knight, and as a boy drew others to the religious life. He became a Cistercian monk, and set himself to kill all sense of enjoyment, all desire for pleasure in his own soul. He seldom took food till he was on the edge of fainting, and when friends came he would stop his ears with flax so that he might hear no worldly talk. This was in his boyhood.

Some time later we hear him saying of book-learning: "You will find something far greater in the woods than in books. Stones and trees will teach what masters do not know. Think you not you can suck honey from the rock, and oil from the flinty rock? Do not the mountains drop sweetness, the hills run with milk and honey, and the valleys stand thick with corn?"

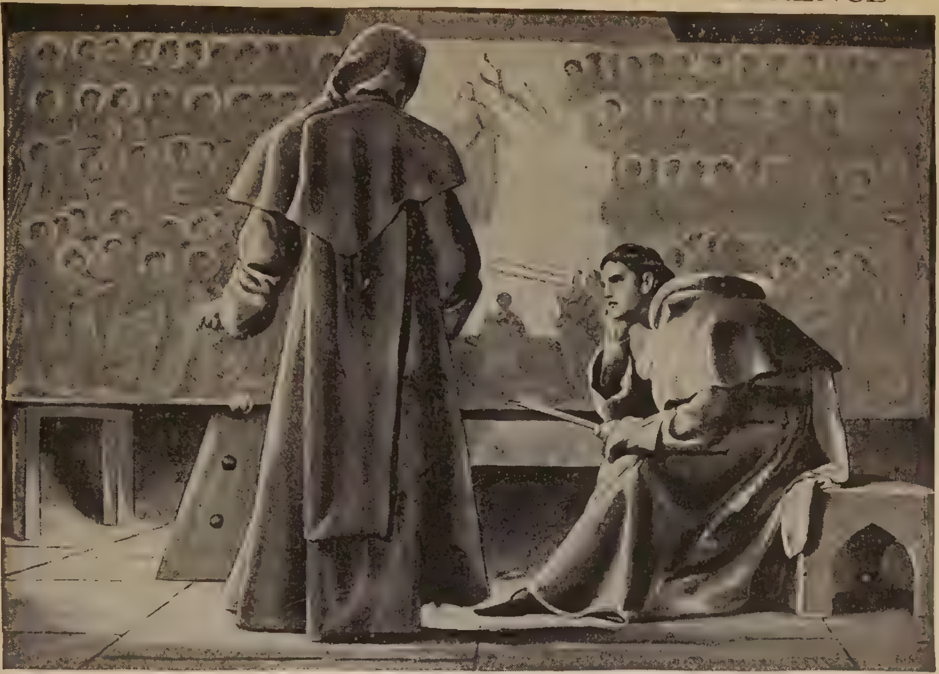
He lived the most hard and desolate life, preaching repentance with a rare eloquence. When he was fifty-five, and worn to a thread, he was bidden bestir Europe for a second crusade. Pale and shrunken, to a degree which seemed almost supernatural, he made a long and exhausting tour of France and Germany, preaching with a success so great that in some districts scarcely one man was left to seven women.

HOW THE GENTLE BERNARD SAVED THE JEWS FROM DEATH

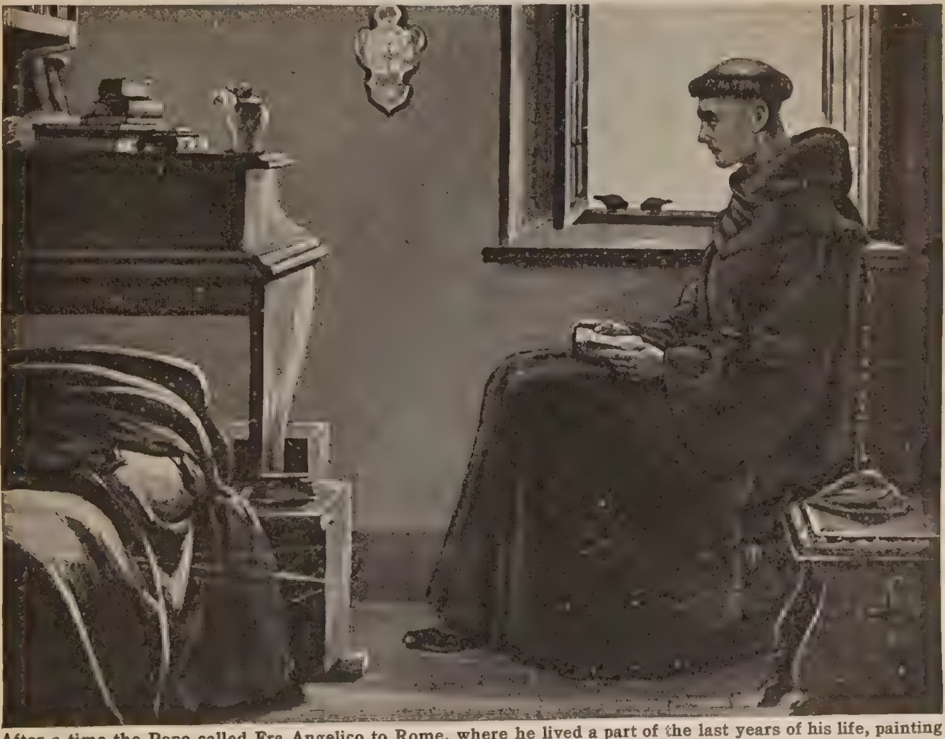
Behind this old man came a young monk stirring people up to massacre the Jews. Bernard turned back, reproached the monk as "a child of the devil," and sent him to his monastery. "Had not the tender mercy of the Lord sent priest Bernard, none of us would have survived," said a Jew. That such a tender and beautiful life of fervid piety should have been lived in the twelfth century is a glory of Christianity. St. Bernard was born in 1091, and died in 1153.

One aspect of St. Bernard brings us in contact with another and far different monk of that period, the man Peter Abelard. He is not a pretty character. Possessed of a brain that used logic as a boy uses a top, he gave himself up to disputing about the most ridiculous things in the world. He passed for a scholar of immense learning. His fame spread. He became a peacock of philo-

THE TENDER ARTIST-MONK OF FLORENCE



One of the best-known painters of Italy was the monk Fra Angelico, who lived for years in the same monastery at Florence as Savonarola. He painted to inspire men to feelings of reverence and devotion, and one of his famous pictures is seen here standing on the easel, while the artist sits upon a stool by its side.



After a time the Pope called Fra Angelico to Rome, where he lived a part of the last years of his life, painting pictures in the Vatican. Mr. Ruskin has said that Fra Angelico was able to express the sacred affections upon the human countenance as no one else before him ever did. Here is Fra Angelico at his devotions.

sophy, a dandy of theology. He went from town to town airing his knowledge and refuting other teachers. In the height of his fame he fell in love with a girl he was engaged to teach, and married this Héloïse secretly, lest he should be stopped from advancing in the Church. Then his enemies, stirred up by his pride, came about him. He was persecuted, and had on some occasions to flee for his life. He was accused of heresy. St. Bernard was set to dispute with him. The poor old faded monk was bidden to stand in conflict with this great "scholar."

We are told that, hearing the eloquence of St. Bernard, Abelard refused to argue, and appealed to Rome. Rome condemned him. He entered a monastery, sick of the world; his wife went into a nunnery. But his persecutions lasted almost to the day of his death. For Abelard condemned the wicked lives of the monks whose lot he shared, and these men made it hard for him. His reputation as a scholar, however, continued, but he was no longer the swaggering coxcomb seeking to dazzle and attract. He died a broken-hearted man, having spent his last years in writing rather cold and formal letters of religious instruction to his wife in the nunnery. Abelard lived from 1079 to 1142.

THE EXTRAORDINARY STORY OF ST. DOMINIC AND THE BLACK FRIARS

If every person who crosses Blackfriars Bridge in London knew how it came by that name, what a great multitude of people would know the extraordinary story of St. Dominic! The name comes from one of the most striking figures in the Roman Church—a Spanish priest known as St. Dominic. He began life with a beautiful and earnest devotion to Christ. As a boy he prayed often; at the university he sold his clothes in a time of famine to feed the poor, and offered to go as a slave to Morocco in place of a poor woman's brother who had been captured by the Moors. He was ordained a priest, and soon became known for the rigor of his life and the eloquence of his preaching. So far Dominic was simply an earnest son of the Church. But a day came when he went on a mission, and no sooner had he left Spain, where the people feared and obeyed the priests, than he found himself among people of a very different character. Shocked by their disobedience, their heresies, and the manner of their life, Dominic set himself to reform or punish them.

Meeting a magnificent cavalcade from Rome on the same mission, he exclaimed: "How can you expect success with all this secular pomp! These men cannot be touched by words without corresponding deeds. Throw aside your splendor, and go forth as the disciples of old, barefoot, without purse or scrip, to proclaim the truth."

THE POOR MONK WHO FOUNDED THE DREADFUL INQUISITION

Dominic practised what he preached, and became a barefooted, black-robed, mendicant friar—a black friar—and set out to convert these disobedient children. But, alas! success did not attend his efforts, and he had to say at last: "I have spoken to you with tenderness, with prayers, with tears; but, according to the proverb of my country, where the benediction has no effect, the rod may have much. Behold how we rouse up against you princes and prelates, nations and kingdoms, and many shall perish by the sword!"

Some historians have claimed for him the terrible responsibility of having organized the Holy Inquisition—that great organization which tried and condemned men, women, and children in the name of God—but this is doubtful. We know that a man of the purest saintliness, the most devout and simple piety, may become very harsh and stern in the cause of righteousness. Dominic, in addition to this zeal and intemperance, was a man of great genius and much faith. He was born about 1170 and died in 1221.

ROGER BACON, THE ENGLISHMAN WHO WAS SAID TO KNOW EVERYTHING

A great scholar-monk was the English Roger Bacon—"the miracle of the age he lived in." He was said to know everything. He marks for us an interesting place in human history. For many centuries, learning in Europe seemed to be almost dead. But toward the end of the twelfth century a desire for new knowledge awoke, and by the thirteenth century men, no longer content with what had come down from the ancients, had begun to try to search into the unknown. As yet, most of the learned men were in the church, and thus it was that one of the greatest of the pioneers of science in all Europe was a friar—an Englishman, Roger Bacon. This friar studied chemistry and astronomy, but soon his knowledge gave offence, and he was imprisoned in his friary in Paris. After some time, he was released at the request of the Pope, and was allowed to return to England. But, later on, he was again put under arrest, and kept in prison for the greater part of the rest of his life. He lived from 1214 to 1294.

THOMAS A KEMPIS, THE LITTLE MONK WHO WROTE A FAMOUS BOOK

Early in the fifteenth century, when Europe was in a state of the greatest confusion—England fighting France and the Turks attacking Hungary, while two Popes, existing at one and the same time, were making havoc of Church government—there lived in a poor monastery in Germany, earning bread for himself and his brother monks by copying religious books, a little man, with soft brown eyes, whose name was Thomas à Kempis.

That name was then quite unknown outside the monastery walls. To-day it is known in practically every language under the sun. The little monk knew nothing of the storm in the world; he was perhaps quite unconcerned as to whether the Pope at Rome or the Pope at Avignon triumphed in the struggle. Such things did not seem to him of much importance. When he spoke of obedience, he did not think so much of temporal rulers and ecclesiastical superiors; he meant the obedience of "the lower part of man's nature to the higher, and of the whole to God."

He was a deeply religious, profoundly pious man, who lived a useful and contemplative life. The noise of cannon and the shouts of kings reached his ears like the sounds of children at play. This quiet and simple little man, besides copying other people's books, wrote some of his own. One of them, called "The Imitation of Christ," which he gave to the world without his name, tells the simple story of the soul in communion with its invisible destiny.

HOW THOMAS À KEMPIS MADE HIS NATIVE TOWN KNOWN TO ALL THE WORLD

But so sweet, so true, so natural, so golden with the breath of a loving, yearning soul is this little book of the little monk, that it has been translated into more languages than any other book in the world except, of course, the Bible.

Little did Thomas à Kempis imagine, while he wrote, that those words of his would become the heart-literature of Europe for centuries. He had been reared in a poor cottage, the son of overworked peasants, and his name of Thomas Hammerken had been changed at school to "Thomas from Kempen," Kempen being the name of the little town where his peasant mother had nursed him. How wonderful is it that this man has sent the name of that humble German town round the whole earth by just writing down, again and again, that he loved God and desired immortal life! Thomas à Kempis lived from 1379 to 1471.

A very famous monk, one of the men who helped to make Florence beautiful, is mentioned on page 2797 of this book. This is the painter known to all the world as Fra Angelico. In books his name is often given as Fiesole, or as Fra Angelico Fiesole. This may seem a little puzzling, but the explanation is simple. His name was Guido—we do not know his other name. When he became a monk, he had to forsake his own name, and take that of Giovanni. Giovanni is the Italian name for John. Whence, then, came the names Angelico and Fiesole? He was born at Fiesole, the little hamlet on the hill above Florence, and he was called the "angelic friar," because of his paintings of angels.

FRA ANGELICO, WHO LIVED A BEAUTIFUL LIFE & PAINTED BEAUTIFUL PICTURES

It was in 1387 that Fra Angelico was born, and when he was twenty years of age he entered the monastery at Fiesole, to devote his life entirely to religion and painting. He painted nothing but religious subjects, and preached beautiful sermons with his brush. His first paintings, as a young monk, were probably done at the city of Cortona, where a number of his pictures are still to be found. In 1418 he was recalled to Fiesole, and labored there until 1436. Then he went down the hill into Florence, to reside in what was then the Dominican convent of St. Mark, but is now a national museum.

Here he executed some of the most famous of his paintings which are still to be seen. Some remain where he painted them; others have been removed to places more secure. Most of them have been left just as his brush finished them; those which have been "restored," as it is called, have been spoiled. His fame spread, and he was called to do paintings at Orvieto and Fiesole.

Fra Angelico's work at Fiesole is not entirely unknown in England, which is fortunate enough to possess a specimen of it in the National Gallery. It is a magnificent painting of Christ bearing the banner of the Resurrection, attended by a host of saints. This picture serves to show how industrious Fra Angelico was, for in it no fewer than 266 figures of saints are drawn. After he had been nine years at Florence Fra Angelico was summoned by the Pope to Rome. The Pope had heard of the painter's godly life as well as of his work as an artist, and is said to have wished to make him Archbishop of Florence.

HOW THE HUMBLE FRIAR REFUSED HONOR AND DIGNITY

The painter was as modest as he was good and skilful. He prayed the Pope not to make him accept the dignity, and the Pope permitted him to remain a humble friar, and appointed instead a friend of Fra Angelico. In 1445, and again in 1455, Angelico worked in the Vatican. He died in Rome in the latter year, and there he was buried.

There never was a more beautiful life than that of Fra Angelico. He labored with all his zeal for the poor, who regarded him as a brother. He regarded his ability to paint as a gift from God. When he wished to paint he used to kneel and pray. Then he rose and did the work upon which he had set his mind. What he once painted he never altered.

Fra Angelico felt that everything he did as an artist was in answer to his prayers, and that therefore it must stand, as of too holy an origin to be touched up or improved. Religion was to him his hope and joy, and he tried to lead others to share his rapture by the most beautiful paintings of heavenly beings, and by presenting, with all his tender genius, the stories of the Bible. He painted the sorrows of Jesus as well as His triumphs. These were sad days in the life of Fra Angelico, and he would weep bitterly as he painted the Crucifixion.

SAVONAROLA, THE GREAT MONK WHO MADE KINGS TREMBLE

Savonarola is one of the picturesque figures of the Middle Ages. In the midst of that gorgeous, wicked, and careless period, we see the shrunken figure and the gaunt face of a little hooded man, whose glowing black eyes, flashing judgment and anger, glance like lightning on the crowd from under the shadow of his cowl. He was terrible to sin. Rulers feared him, wicked people maligned him, and the populace was swept like a sea by the tempest of his preaching. He came from his monastery to chastise the world. The world accepted the conflict. Savonarola was raised high in honor, then tried, tortured, hanged, and burned. His ashes were thrown into the river.

Such, in brief, is his history. When we look more closely at this great figure we are puzzled by many things. Some people would have us believe that scarcely a greater hero ever crossed the earth; others that he was perhaps the grossest impostor who ever lived. Today men read history not to take sides in a fight, but to see the truth of things. Savonarola appears to us now a strange mixture of nobility and delusion. We call him a hero, we cannot call him an impostor; but we can criticize him.

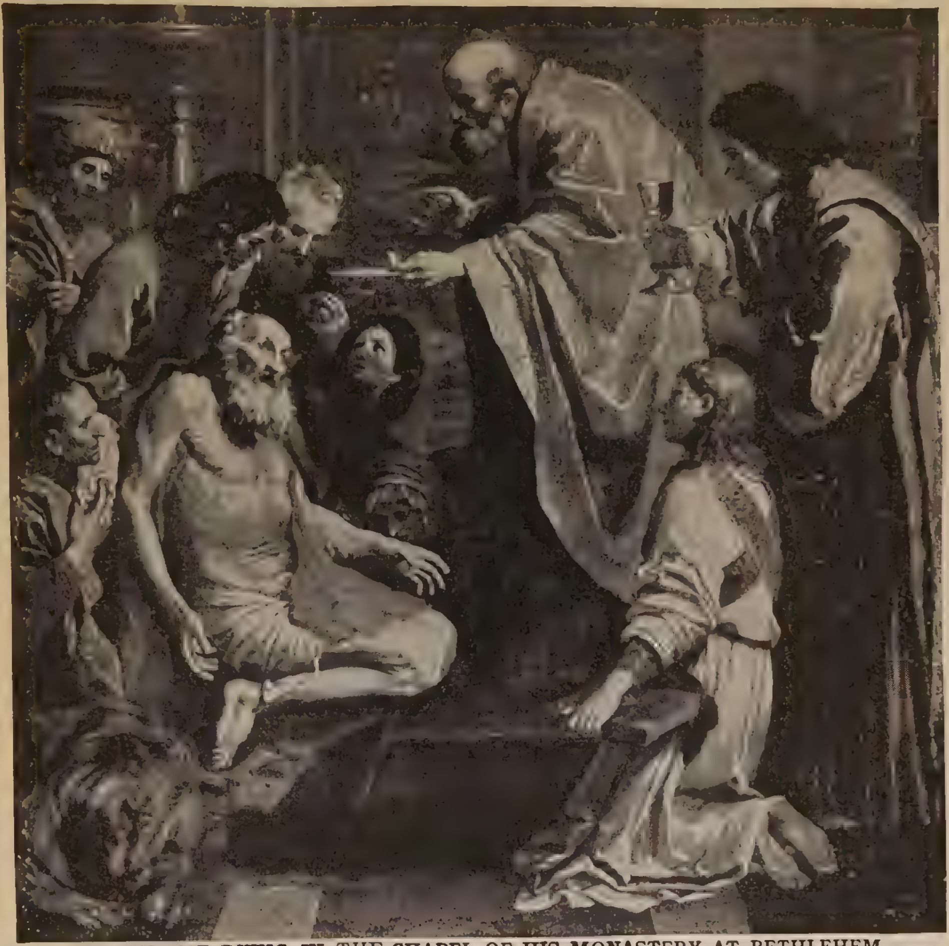
He seems to us not a man who sought to deceive, but was himself unconsciously deceived. He believed, for instance, that evil spirits came and wrestled with him in his cell; that the Holy Spirit settled on his shoulder in the form of a dove, and spoke in his ear through the dove's beak; he declared that he conversed with God; he saw visions of the most frightful and appalling description.

HOW THE SEVERE LIFE OF SAVONAROLA AFFECTED HIS THOUGHT AND ACTION

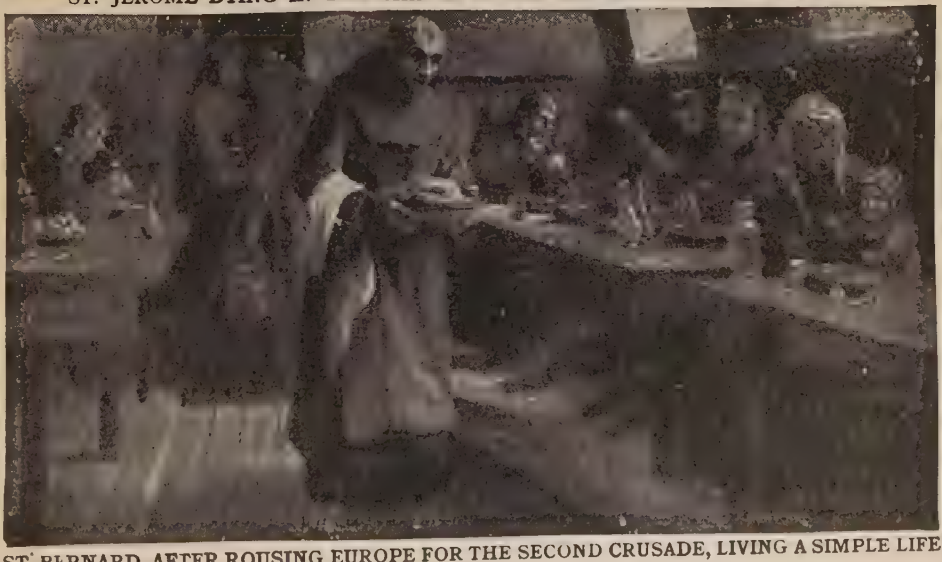
All this, in our day of calm reason and medical knowledge, assures us that the hero-like soul of this good man was afflicted by the distempers of his brain. The preacher who sways a multitude needs a cool head. The severe discipline practised by Savonarola—his brief hours of sleep, his long prayers, his sparing food, his deficiency of healthy physical exercise—unfitted him for meddling in politics. He was certainly a very dangerous man.

But his courage was magnificent. His hatred of vice and luxury was most honest. The wickedness of the Court of

THE LAST COMMUNION OF SAINT JEROME



ST. JEROME DYING IN THE CHAPEL OF HIS MONASTERY AT BETHLEHEM



ST. BERNARD, AFTER ROUSING EUROPE FOR THE SECOND CRUSADE, LIVING A SIMPLE LIFE

Rome hurt his noble soul to the quick. If ever a man felt the sharp contrast between the simplicity of Jesus and the magnificence of His Church, it was this fiery prophet of Florence. As he passed to the gibbet on which he was burned—in sight of the beautiful cathedral shown on page 2789, where crowds had flocked to hear his preaching—a bishop said:

"I separate thee from the Church militant and the Church triumphant."

"Not from the Church triumphant," replied the monk, with quiet confidence, "that is beyond your power."

THIS FLORENTINE REMAINED A MONK OF THE ROMAN CHURCH

Protestants have claimed him for a martyr; but he appears to have adored the Sacrament before his death, and to have confessed himself a true son of the Roman Church. Savonarola was born in 1452, and died in 1498.

The famous portrait by a fellow monk, Fra Bartolommeo, is given in the group on page 4029. It was painted from life, and the original still hangs in Savonarola's cell at the monastery of San Marco in Florence.

In 1491 there was born in a Spanish castle a boy destined to become one of the most famous men who ever threw off the world to put on the monk's hood. This was Inigo Lopez de Recalde, known to history by his monk's name and his Roman sainthood, as St. Ignatius de Loyola. He was a nobleman, and grew up on his father's estate without learning of any kind. He became a page in the court of Ferdinand, and, later, embraced the profession of arms. While following the calling of a soldier, he was severely wounded in the right leg at the siege of Pampeluna. While he lay in his father's castle recovering himself of this wound, certain books of religion, given to him to while away his idleness, laid a hold on his soul.

THE SPANISH SOLDIER WHO FOUNDED THE ORDER OF JESUITS

When he rose from the bed it was to journey to a church, where he hung up his soldier's arms, and vowed himself to live a religious life. He removed himself to a hospital, and worked in menial offices to learn humility. Then he journeyed to Jerusalem, and came back inspired with the idea of founding a new religious society. He put himself to school to learn. While learning he began to influence men. Directly he stated his simple views, however, the hand of authority seized upon him, and he had to flee. From city to city he went, begging his way, until at last in Paris he found freedom, and there he lived as a mendicant. At the university his persuasive powers drew certain young men to his side, and at the age of forty-six he was ordained, and set out on his preaching mission.

His burning zeal had drawn around him a remarkable group of men. Six of them met with him in 1534 in the Church of Montmartre and bound themselves to chastity, poverty, and obedience to their superiors. From such small beginnings, made with difficulty and against great discouragement, one of the greatest religious orders sprang.

The miracle of Loyola lies in his creation of the Jesuits, a society spread all over the world, and working in many languages to one and the same end.

For a man who was not ordained until he was nearly fifty, and who was fighting at the age of thirty, this is a most remarkable achievement. Loyola is not responsible for the political power which his society soon gathered. His influence was purely spiritual.

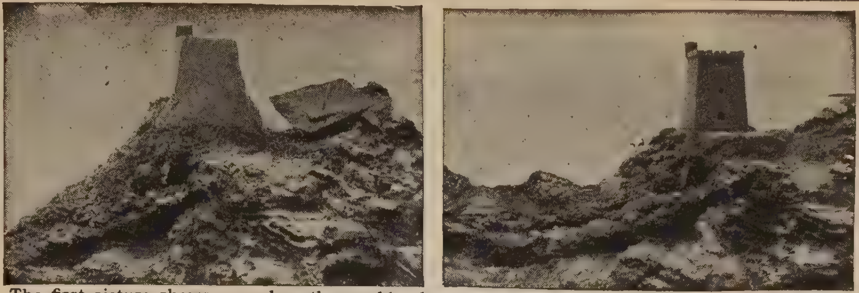
THE WONDERFUL POWER THAT LOYOLA HAD OVER MEN

He drew men to him by the force of his holiness. It is narrated of him that while in Paris he sought to gain the affection of a young student named Xavier, who withstood all his advances.

One day Xavier, having done well in the class for philosophy, was strutting about in great pride, when Ignatius came to his ear and whispered: "What shall it profit a man if he gain the whole world and lose his own soul?" Xavier was converted, and became the famous St. Francis Xavier of the Jesuits. Such was the real power of Ignatius—a personal influence on the side of holiness. Loyola died at Rome in 1556, worn out by his labors and his severe life.

The distinguishing feature of the Jesuit Order is that the members do not retire from the world and shut themselves up within the forbidding walls of a monastery. They are active in the homes of men, in the legislatures of nations, and in the councils of Rome. They are monks of the world.

THE NEXT MEN AND WOMEN BEGIN ON 4099.



The first picture shows a sand castle roughly shaped, and the second picture the castle finished.

BUILDING SAND CASTLES

CONTINUED FROM 3968

ONE of the delights of a holiday spent at the seaside is the building of sand castles on the beach. But we need not be content with what is usually called a castle—that is, a great pile of sand heaped up with little regard to order. We can, with skill and patience, make a really good model of a castle, like that we see upon page 4041.

First of all we must choose a suitable spot, where there is plenty of clean, damp sand, and pile the sand up into a heap something after the shape of the castle we wish to build. To begin with, we can do something simple, such as a round tower, or perhaps a castle gateway. While piling it up, we must beat it well together, so as to make it all as firm and solid as possible; especially must it be well pressed together at the top if we are going to cut out embrasures on the battlements.

If the day is hot, or the sand dry, it will be well to moisten the rough heap, either from a watering-can with a sprinkler or by carefully splashing the water on by hand from a pail or other vessel. The heap must not be wetted too much, or the walls will collapse. After a little practice, we shall be able to judge how wet the sand must be to make it bind well together, but we shall always see signs of too much damp near the foundations first. The heaping up is best done with the spade, and it is well, in the case of a small castle or specially fine work, to pile it on in handfuls, patting it down carefully so that there are no cracks or flaws. Stones, shells, or bits of seaweed must be avoided.

The carving out is roughly done at first until about the right shape is obtained, and then, beginning from the top, the work is finished off till the bottom of the walls and the ditch claim attention.

A small spade can be used for the rough shaping, but the final trimming needs a smaller tool. A kitchen knife is suitable, and with this the sand is literally cut into shape. When using these tools, we must always remember to make a slicing cut, especially when carving near corners, or the edge of the work will be broken away in pieces.

Let us take, as an illustration of the proper methods of sand-working, the building of a tower with battlements. The moulding being done, we first trim off the upper part till it is level all round, and then mark out the top with a knife to show where the openings will come. Having divided it up equally—that is to say, with the openings at regular intervals—we make slicing cuts with the knife, always inwards, to the right depth, and then lift out the cut parts on the knife, thrusting it in from the front. If we do this neatly with a steady hand, those parts of the castle will not need touching again. If, however, pieces are broken away, they can be replaced without much trouble.

When the openings are cut, the battlements must be trimmed to the right thickness, and the centre dug out to form the flat roof. We must do the digging towards the centre, so that no pressure is put on the battlements, or they will be easily broken away. For all digging-out operations, making archways or tunnels, an iron spoon is an invaluable tool.

The battlements being complete, the lower work may now be continued. We cut the walls nearly straight down, roughly at first, and then mark out where the cornice of the battlements will come, for an overhanging cornice adds much to the appearance. The line must be straight, and it is well to use a lath of wood as a ruler if it is at hand; we now cut down at the proper angle, and trim off the sand below, until the walls are even and vertical.

After trimming, the walls will need to be provided with some windows and, perhaps, arrow-slits. We mark out the windows with a point before cutting, so that we can see that they are level and in the right places. If we make mistakes in marking out, the marks can be erased by rubbing with the finger. When ready, they will be cut in deep and dug out with a knife if small, or with a spoon if large; care has to be taken lest the edges of the opening are broken. Arrow-slits, if small, can be made with the end of a knife dug in deep and moved from side to side before pulling out.

The arched entrance is made in much the same manner as the windows, only, as it will be tunneled in deep, or perhaps right through the wall, a spoon with a long handle will be useful.

If the back of the wall is to be trimmed down or cut thin, it should be done after the front is finished, and probably will need to be done only roughly; but we must be very careful not to be in too much hurry, and trim it off little by little, always letting the pressure of the tool fall on the sand to be removed, and not on the finished work. If all this is done intelligently, it is really quite wonderful what high, thin walls can be made. But do not be too ambitious at first; good stout walls, with one side carefully finished, will be best till practice makes perfect.

If we look at the pictures on the top of page 4039, we can see how the castle appears during the course of construction and when it is finished. The tools can be seen on the right of the first picture—a square of stout cork linoleum picked up on the beach, with which the sand was lifted on to the rock; the end of a small wooden box, also found on the beach, which served as a spade; and a small 4-inch steel rule and a pocket-knife.

When building on rock foundations, several difficulties have to be guarded against. When working with wet sand, the tendency is for the water to filter down to the bottom, especially as the sand is patted and pummeled a good deal, and as it cannot soak away at the base, as is the case when building on a sand foundation, it collects when it reaches the rock, and the mass will divide in two, owing to the sand running away.

To prevent this difficulty, or to remedy it if it arises, several methods are available. If there is any question as to the sand being too wet at the start, it will be well to begin with some fairly dry sand at the foundations, using wetter sand near the top. If, after the work has proceeded some time, there is evidence of the base becoming too wet, take out a few handfuls close to the rock and replace it with drier sand. Another plan is to surround the base with quantities of dry sand to soak up the water, which can be easily cut away as the work proceeds. Perhaps this last method is the best for a young builder of sand castles.

SOME GAMES PLAYED WITH HOOPS

A HOOP RACE

A WINNING-POST is fixed upon, and all the runners stand with their hoops in a row, waiting for the word to start. Then away they go as fast as they can, bowling their hoops, and the one who reaches the winning-post first with his hoop wins the game. A very good way to add to the fun is for everyone to change hoops just before starting on the race, and to make it a law that the last hoop to reach the goal wins. Each player will try his best to get in front, hoping that the one who has got his hoop will be left behind.

TURNPIKES

IN this game a course is mapped out on the field, and, at certain distances apart, short sticks, with an inch or two of space between them, are stuck side by side into the ground. These are "turnpikes," and if no sticks are handy, bricks or stones may be used instead. The players take hoops and bowl them round the course, steering them through the turnpikes, but should they, in passing on either side, touch one of the pikes, it will count as a mark against them. When the course has been traveled over three times, the number of bad marks against each player is counted, and the one with the fewest marks is the winner. The players must not walk, and should not go slower than a trot.

HOOP PARADE

THIS game might be called "follow my leader with a hoop," and when carefully played makes a pretty pastime for girls or boys. The more that join in it the better the effect. The leader starts off with her hoop at a trot, taking a circular course, and all the others follow behind her. By quickening the speed she presently comes up behind the last girl in the row, and a large ring is thus formed. Then suddenly she turns her hoop to one side and makes another ring, only in an opposite direction, much as we write the figure 8. This may be kept going for some little time, or varied as the leader's ingenuity can suggest. Of course, all who take part in this game should be more or less skilful hoop-bowlers.

HUNT THE STAG

WE want plenty of space for this game and plenty of players. The best runner, who is called the stag, is chosen, and allowed a few moments' start with his hoop. Then away go all the hounds after him, also bowling their hoops, and if the stag knows how to dodge, he may make the others quite breathless before he is caught.

POSTING

THE players stand in a large circle, some yards apart, their separate "stations" being marked by a stick or a stone. Number 1 has all the hoops, and starts the game by running toward her next neighbor, bowling the first hoop as she goes. When half-way she stops, gives the hoop an extra push, and runs back to her station for the next hoop. Meanwhile number 2 has started on with the first, which she bowls to number 3, but she must be back in time to receive the second. Thus, one by one, all the hoops are set in motion, each player running backwards and forwards between her next neighbor and her own station. With care and skill the hoops may be kept going round the circle for some time, but a single mistake means the end of "posting," for where *all* the hoops are in motion it is not possible to make up any lost time.

BUILDING A SAND CASTLE ON THE BEACH

A bucket and spade, a supply of sand, and willing hands with plenty of patience are all that is necessary for the making of a fine castle by the sea. Here we see the builders beginning the walls and towers.

The arch for the gateway is one of the most difficult parts of the building. The sand must be made wet, so that it will "bind," and not fall down upon the garrison, whom we have to imagine as passing in and out.

Patience and skill have at last won a triumph for the bucket and spade; and here we have the ramparts of a castle. Any number of fairy soldiers might keep guard behind those sturdy walls; and the little crosses are each the hiding-place of a bowman ready to let fly his arrow at any enemy who may appear.

These three photographs of sand castles and those on page 4025 are by Mr. W. P. Adams.

A USEFUL LITTLE CROCHET PURSE

A SAFETY purse must be used in order to appreciate its usefulness. It is called "safety" because when once the money is dropped in between the chains at the opening, it cannot possibly fall out; it is sometimes worn round the neck on a crocheted chain, and tucked into a fold in the blouse or the belt.

We can, of course, make the purse any size we like. That shown in the picture is a large one, about five inches by three and a half inches. It is made of shaded yellow silk at 15 cents a ball, and crocheted with a steel crochet hook, size No. 3, in the form of a long strip, about one-third of which forms a flap to cover the opening.

We start by making fifty-six chain stitches—if we have not done any crochet work before, we should turn to page 1364—then make three extra chain stitches for the turning, and put one treble stitch into the fourth chain back.

Next we crochet one chain, then put one treble stitch into the next chain below; repeat that into the next chain, again crochet chain, miss a stitch below, and thus repeat one chain two treble to the end of the original chain.

Before turning to work back again, we crochet three chain to form a turning, reverse ends and put two treble into the first large hole below; then crochet one chain over a missed stitch below, and repeat this to the end of the row.

We make thirty-five rows like this, and, without breaking off the thread, start making chains along the edge of one end. These chains are for the purpose of closing the purse.

If we make fifteen long chains into loops along one end, and draw the loops through the row of holes lying nearest when the strip is folded up, the ends of the loops can be crocheted into a ring at the back of the purse. Another crochet chain is then put through the ring, and the chain is made long enough so that it will pass over the head and can hang round the neck.

Now to return to our chains. It will help us to strengthen the edge of the opening, if, while making these chains, we crochet along it; so we make two single stitches into the two chain between the large holes, then draw down the thread through the large hole, and at once start making a fifty-six chain. This chain is very simply made—by taking a single stitch through the same large hole, followed by two single stitches into the two chain along the edge.

Having thus made and attached the looped chain, and without breaking off the thread, we fold up the end of the strip with the chains attached and drag these through a row of holes with the crochet hook, the part above the holes serving as a flap to the purse.

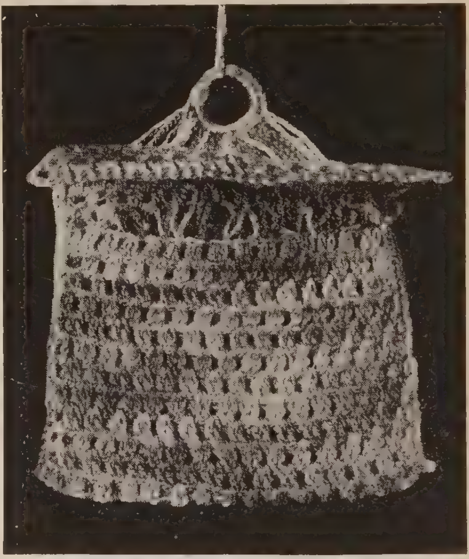
Evidently the next thing to be done is to crochet together the doubled-up edge of the strip on the side where the thread now is. That we do by pressing the two edges together between the left thumb and first finger, so that two stitches are side by side, and then crochet single through the two.

At the end we have to break off our thread by making one extra chain stitch, drawing the thread through, cutting it, and pulling it taut. The loose end is drawn through two or three stitches to hide it. We next join the edges of the opposite side, and continue crocheting round the flap to give it a firm edging.

Lastly, we crochet a little chain of suitable length for a ring, join it up, and double crochet into it all round, drawing into each stitch the looped chains until the fifteen are exhausted.

The purse itself is now finished, and all we have to do is to suspend it round the neck by a long crocheted chain.

As this purse is a fairly large one, and quite a small purse may be preferred, a small bag of a useful size may be made on a chain of thirty stitches with three added for turning, and twenty-seven rows for the strip.



THE CROCHET PURSE COMPLETED

Nine looped chains will be sufficient, and the worker will find that after a time it is unnecessary to count the stitches in these; the chains can be measured to the length of the first one made.

It does not particularly matter how long they are; but they certainly must be of equal lengths, and must also be long enough to allow the purse to open wide enough to drop in and take out coins between them. To close the purse after opening it, simply give a tug to the bottom of it.

Peri-lusta can be used instead of the crochet silk. A ball will make two purses, and it is surprising how quickly two little ones can be made. They are sure to please girl friends.

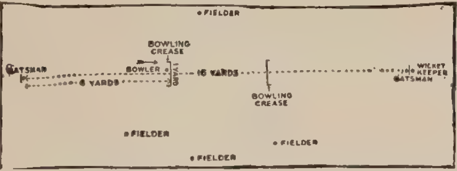
Many people find these purses very useful for carrying gold or silver when traveling.

THE EXCITING GAME OF STOOL-BALL

STOOL-BALL is a delightful game for boys and girls of all ages, and grown-ups enjoy playing it too. It is of old English origin; and many matches are played there each year in September and October. Any good-sized field is suitable for playing in, or it can be played at the seaside on the sands. The outfit for stool-ball is most inexpensive, for we can easily make everything but the ball at home, though spliced bats are very much better than home-made ones, and cost very little. A proper stool-ball outfit consists of two bats, measuring not more than 7½ inches in diameter; a ball, known as Best Tennis No. 3; two wickets, each one consisting of a stake to which a board measuring 12 inches square is mounted. The wickets, when set up, must measure 4 feet 8 inches in height.

Batsman standing ready to take the bowling.

Any number of players may take part in the game, which is really a mixture of cricket and rounders, but six or eight players a side are preferred. To begin the game we set up the wickets 16 yards apart, and mark out two bowling-creases, which must not be over a yard in length, six yards away from each wicket, as we see in the diagram in the centre of this page. This makes the game a very good one for girls, as they have only to bowl 10 yards in order to reach the wicket, instead of 22 yards, as in cricket. Sides having been chosen, we go in to bat two at a time, while the whole of the opposing side goes out to field, except one player who keeps wicket and another player who bowls.



Plan of field, showing arrangement for stool-ball.

Player hitting a catch into the hands of point.

Batsman being run out through misjudging a hit.

The bowling takes place from either bowling-crease in alternate overs of eight balls each, the ball being bowled, not jerked or thrown; and the bowler must stand with one foot at least behind the crease, or the umpire will call, "No ball." The umpire calls out "Over" when every eighth ball has been bowled, a "no ball" not counting in an over. The square board is the wicket, not the stake on which it stands. If, in making a run, the strikers have crossed each other, the player who runs for the wicket which is struck by the ball is out. There are five ways of getting out. If the ball, when bowled, hits the face of the striker's wicket; or if the ball, having been hit, is caught in the hands of one of the opposite side; or if, while running, or preparing or pretending to run, the ball itself is thrown by one of the opposite party so as to hit the face of the wicket; or if any of the opposite party, with ball in hand, touches the face of the wicket before the bat of either of the strikers touches the same; or if, with any part of the person, the striker stops the ball which would, in the opinion of the bowler's umpire, have hit the wicket. Another rule to remember is that no stumping is allowed. When we hit a ball, if we fancy there is time to score a run, we must call "Run" to our fellow-player, and run across to the opposite wicket, each touching the wicket she runs to. The non-striker is held to be "out of her ground" unless her bat actually touches her wicket. Any runs made off a "no ball" which touches neither ourselves nor our bat are scored as "byes." If a striker is run or caught out, the attempted run shall not be scored. The umpire's decision must in all cases be regarded as final, and on all points for which there are no special rules, the laws of cricket hold good for stool-ball also. When we really know the game we shall find it quite as exciting as cricket, and there is no danger of being struck by a hard ball.

GAMES PLAYED WITH DOMINOES

UNLIKE chess and draughts, which are very ancient games, dominoes are not known to have been played before the eighteenth century, when it was introduced into France and Belgium from Italy, and later came into England. Dominoes are very popular here, but in no other country are they played so much to-day as in France and Belgium.

A set of dominoes usually consists of twenty-eight pieces, each divided into two parts with so many spots or pips on each, although in the north of England sets are often used that contain fifty-five dominoes, going up to the double nine, and on the Continent it is quite common to go up to the double twelve.

THE BLOCK GAME

THE simplest game with dominoes is known as the block game. The dominoes are placed on the table with their faces downwards and shuffled. Then each player draws one, and when these are turned up the player with the fewest spots or pips is the one to start the game. The dominoes are now shuffled again and each player takes seven pieces, which he looks at, but conceals from the other players.

The first player now puts a domino down, say, the six-five, and the next player has to play a piece with a six or a five on it. This he places against the corresponding number and the next player's turn comes. If the second player puts down a six-three, then the third player would play to a five or a three. Thus the play goes on until a player has used all his pieces, when he wins the game. If there comes a deadlock, and no player can match the numbers that are up, then all the outstanding pieces of the players must be turned up, and he wins who has the fewest pips.

THE DRAWING GAME

THIS game is played in exactly the same way as the block game, except that when a player cannot go, instead of passing he must draw from the unused stock of dominoes until he is able to play. Two dominoes, however, must always be left face downwards on the table and not drawn. In both the games described it is always best to play the high pieces, such as double six, six-five, double five, and so on, first, so that if in the end no one can go, we may have as few pips left as possible.

FIVES AND THREES

ANOTHER interesting and exciting game with dominoes is called Fives and Threes. The pieces are shuffled and drawn as before, but the game is not to get out first, but to make as many fives and threes as possible. For instance, the first player puts down the five-four. This makes nine, or three threes. He scores three points. The next player must play to five or four, but he must try to make the outside numbers add up to multiply by three or five. He plays, say, a four-one to the four, and the outside added to five makes six, or two threes. He scores two. The next player plays to five or one. He puts down the five-one not to the five end, but to the one, and the outside five added makes ten, or two fives; score two. Now, suppose the next player has the double five, he puts it down crosswise, and both sections of the domino count—that is, ten is added to five at the other end, making fifteen. But fifteen is not only five threes, it is also three fives and so fifteen up scores eight points. Only one other combination will give fifteen, and that is three at one end and double six at the other. Double dominoes are always placed crosswise on the line and the pips on both sections are counted. This is one of the best possible games with dominoes. It is always dangerous to start the game with double six, in case the next player may have the six-three and score eight points.

Two, three, or four players can play at this game, and the number of points to be played up—usually 31 or 61—is always decided beforehand by the players.

THE GAME OF MATADOR

IN this game, instead of matching a number, we have to place down a domino so as to make up the number seven. Thus, if the first player has played the five-two, we must play a piece with a two or a five on it, so as to make a seven with one end of the first domino. Suppose the second player puts down a two-six; the end numbers are now six and two, and the next player must put down either a one or a five to make up seven. When a domino is played that makes a blank at the end, this blocks that end, and only a matador domino can be played there.

There are four matador dominoes, the double blank, and the three pieces that have seven pips upon them, namely, the six-one, the five-two, and the four-three. A matador may be played to any number, even if one of its squares does not make up seven with the last piece played, but the piece played to a matador must make seven in the ordinary way.

As a matador may be played to any number, it is wise to keep our matadors in reserve for a difficulty. In playing this game each player takes seven pieces, but when we cannot go we must draw from the reserve, as in the drawing game.

All these games of dominoes may be played by two, three, or four people, and four may play either as individuals or as partners.

OTHER GAMES

THERE are, of course, variations of these games which are sometimes played. For instance, matador can be played by using five or some other number as matador. If five were taken as matador, then the matador pieces would be five-blank, four-one, three-two, and the double blank; if six were matador, then six-blank, five-one, four-two, and three-three, and double blank would be matador pieces—that is, there would be five instead of four such pieces. Similarly, the game of fives and threes can be adapted to twos and fives or fours and fives, but experience has proved fives and threes to be the best and most interesting combination.

THINGS TO DO IN AWKWARD SITUATIONS

WITH HINTS FOR BOY SCOUTS

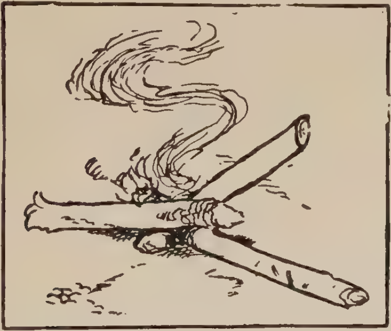
IT is essential for any boy who wishes to become successful in life that he should be full of resource, and able to adapt himself to every circumstance in which he is likely to be found. Such resourcefulness is needed not only in boy scouts, but in every boy who does not belong to any organized body of scouts. There are many things that a boy may do when out for a day in the country that will fit him for real scouting and camping work, should the need for such work arise.

TO CARRY WATER

There are various ways of conveying water from one place to another when we have no pails or proper vessels for the purpose. Canvas bags, smeared with grease on the outside, are quite waterproof after they have been soaked for a short time. A basket with oiled cloth arranged inside makes a useful bucket, and if an old cocoanut shell is handy, it may be used for holding water. It is worth remembering that if we are carrying water in pails, some grass picked and placed on the water prevents it splashing. A hole in a leaky vessel may be stopped temporarily with rag or grass well greased over.

TO LIGHT A FIRE

In these days of cheap sulphur matches, there is rarely any need for us to "make fire" when we want to light a fire of wood. But even with matches it sometimes happens that a whole boxful may be wasted on a windy day before the fire can be lighted. It is useful, therefore, to put an overcoat or cloak over our head and over the piled-up wood before we strike the matches, and then, if we have taken the precaution to gather plenty of dried grass and small twigs, we shall have no difficulty in lighting our fire. Wax matches are much better for outdoor use than wooden ones, as the latter get damp in wet weather if they are exposed to the air for long. If we have nothing dry to rub the match upon, we may ignite it by scratching the head of it with the blade of our penknife.



The right way to make a log fire.

FUEL FOR FIRE

It may not always be easy to get wood for fuel, and it is worth knowing that there are various other substances that travelers use for this purpose. Bones of animals are very useful for this purpose, particularly if fresh; but even the bones of cooked meat, if added to a fire, will burn well. The dry manure of cattle, as found upon the ground, is also very useful, and is not at all disagreeable as fuel. If nothing better offers, dried seaweed will burn with great heat, although it does not make a fine cheerful fire. If large logs are being used for fire, two or three of them should be arranged as shown in the picture, the dark ends being the part in the fire. As they burn away they are pushed forward, and so are burned according to a regular system.

TO REST IN A GALE

To lie down and rest in the open air when a gale of wind is blowing, we must not make the mistake of getting under a tree, which provides a good roof high up, but has no wall. What we need is a wall, and a wall about eighteen inches in height will be quite high enough.

This may be provided by turning up the turf if we have a spade, or by piling up stones, or perhaps we may find a little hollow with a natural sheltering wall. In a heavy gale there is always a violent eddy in the neighborhood of a tree, and the result may be seen in a cornfield after a storm, where the corn in the open is unharmed, but that near the tree is all beaten down. It is always warmer to lie down under a cloudy sky than under a clear sky, for the clouds act as a blanket. On sandy plains travelers often keep themselves warm when sleeping at night by burying all but their heads in the sand. The same plan is followed in snowy lands, the snow making a really warm covering and protection from the cold air.

A SIMPLE MATTRESS

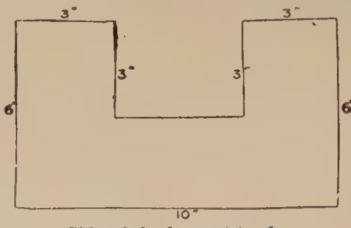
When resting or sleeping in the open air, it is as necessary to have something to lie upon as to have proper covering for the body, otherwise the part of the body that is in contact with the earth may get chilled. All kinds of things will provide a useful mattress, and in this matter we may imitate the bird in making its nest. Dried grass, leaves, feathers, heather, wood shavings, bundles of faggots, newspapers, and such material, can be used with advantage, and if the ground is really wet, an excellent bedstead can be made from a heap of stones or a couple of tree-trunks rolled together, if such are available.

SEATS FOR A MEAL

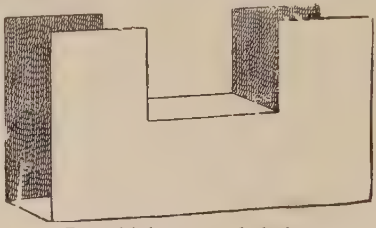
If we are going to make a stay in one place for any length of time and have no furniture, it is a good plan to dig a trench. This provides both chairs and table, for we can sit on one side of the trench with the feet and legs in the hole, and the other side of the trench makes a handy table. In this way we have a much more comfortable seat than we otherwise should have if we just sat about on the ground or on any odd log that happened to be about.

If we are not staying long enough in any place for it to be advisable to dig a trench, we can gather up any dry litter that may be lying about and sit on that.

HOW TO SEE THROUGH A BRICK

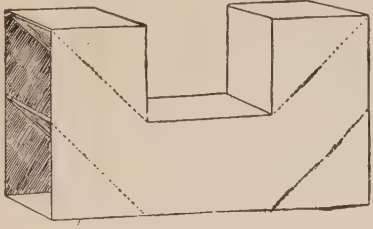


1. Side of the box cut to shape.

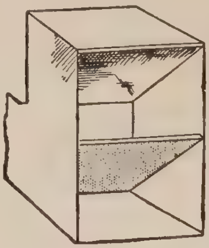


2. Box with bottom and platform.

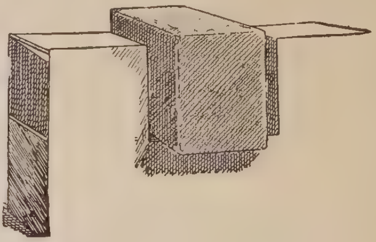
ONE sometimes hears the expression, "I can see as far through a brick wall as anybody else." We shall learn in this article how to make a clever little toy that will enable us to see through a brick, or a book, or a slate, or anything else that is not too large, so that if we hear the expression again, we can tell the speaker that we can teach him how to see quite easily through a brick. We need some pieces of wood—ten in all—about a quarter of an inch thick, and of different sizes. We should see, when we join the pieces of wood together, that all the joints are light-tight—that is to say, that they admit no light. If we do so, the result will be better than it would be if we neglected this point. We cut out two pieces the shape of picture 1, and of the sizes marked in picture 1; then one piece ten inches long and four inches wide, and another piece four inches square. We nail or glue these four pieces together, as seen in picture 2. Now we make and add an upright piece at both ends of the square piece; this will require two pieces of wood four inches long and two and three-quarter inches wide. Then we make two pieces for the top of the box; these will be four inches long and three and a quarter inches wide. When they have been added to the box, it will be as seen in picture 3. Now we must get four pieces of looking-glass all the same size, four inches long and three and a half inches wide. We fit one piece across the inside corner of the box at one end, as seen in picture 4. This must be put in face outwards and at an angle of forty-five degrees with the top of the box—that is to say, the two side edges of the glass will be at equal distances from the corner. Now fit another piece of mirror in the similar corner at the other end of the box. We fit the other two pieces of looking-glass, backs outwards, at the bottom of the box at each end and at an angle of forty-five degrees from the bottom of the box. This is shown in pictures 3 and 4. Now we get two pieces of wood four inches long and three and a quarter inches high, which we put on at each end behind the backs of the lower pieces of mirror. Our toy is now complete, as seen in picture 5; but if we paste colored paper over it right round outside it will improve its appearance, and also help to make it light-proof at the joints. If we place a brick or a book or anything else of a suitable size on the platform in the middle part of our box, we shall find that, on looking in the opening at one end of the box, we can apparently see right through the brick or book. The effect will be more striking if we have a light—say, a window or a candle—opposite the other aperture. Then the light will seem to shine right through the solid brick or the book when we look into the other aperture. The mystery of how this comes about is made clear in picture 6, which shows what happens inside the wonderful box. If we follow the dotted line from the eye through the box and out at the far aperture, we can understand how we can see through the brick. The mirrors enable us to see not precisely through a brick, but rather round the brick; but the effect is exactly the same as if we saw through the brick. The whole secret is explained by the words multiple reflection, which means that the reflection of the image is thrown from one reflecting surface, or mirror, to another reflecting surface. Good results are attainable only when the mirrors are placed exactly at the proper angles. Therefore care must be given to the angles at which the mirrors are fixed when the toy is being manufactured.



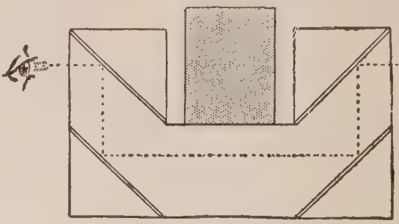
3. Box after the mirrors are fitted.



4. End, showing mirrors.



5. Completed box, with brick in place.



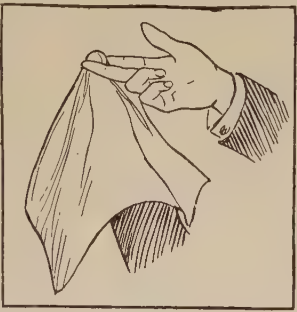
6. Diagram showing the line of vision.

THE COIN AND THE HANDKERCHIEF

THE young wizard will find this a trick after his own heart. It is completely deceptive. It may be exhibited offhand, with any penny, and with any handkerchief. Lastly, it is very easy of execution. Its only drawback is that the necessary movements are a little bit difficult to explain in writing.

The performer begins by borrowing a penny and a handkerchief. A conjurer should always borrow when he can, because anything of his own always lies open to the suspicion, however unfounded, of being in some way specially prepared. Besides, the lenders of the articles used in a trick feel a sort of personal interest in it. In the present case the performer may also ask for the loan of a short piece of string, though there is no objection to his providing this for himself.

Taking the penny in his left hand, and holding it upright between the forefinger and thumb, he throws the handkerchief over it, letting the four corners hang gracefully down around it. "Let us settle it comfortably," he remarks. So saying, he nips the coin through the handkerchief, between the first and second fingers of the right hand, held *palm upwards* as shown in the picture, and tilts it over towards the left.


How to hold the penny.

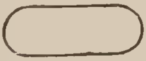
The forefinger and thumb of the left hand release the coin for a moment, and nip it again by its opposite edge, through the handkerchief. The upright hand is then removed.

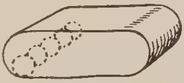
"Now," says the performer, "you would hardly suppose that this simple movement has already caused the coin to vanish. You wouldn't? You are quite right, for here it is still." As if to prove the words that he has just uttered—though nobody in the audience doubts them—he lifts with the right hand the hanging portion of the handkerchief and shows the coin. "Once more we will cover it over." He lets the handkerchief fall around it on all sides. "To make the coin still safer," he says, "I will ask somebody to tie this piece of string round the handkerchief." This is done at a distance of about six inches from the coin. "And now," he continues, "I want the assistance of the strongest gentleman in the company." Someone having volunteered, he says: "Now, sir, I want you to take hold of this handkerchief"—he gives him the hanging portion—"and hold it as tightly as you can. Now you and I will have a little tug-of-war, but in a new way. I am going to try whether I can't pull the penny right through the handkerchief. It is not gone yet, you see." He shows the shape of the penny through the handkerchief. "Now, then, pull as hard as you like! One, two, three!" He himself makes believe to pull with all his might and finally lets go the handkerchief with a sudden jerk, the penny remaining in his hand. The secret lies in the fact that by exactly following the instructions given, which, if followed closely, will be found in practice perfectly simple, complicated as they may look in print, the coin is left, after it has been shown for the second time and the handkerchief let fall around it, in an outside fold, whence, under the pretence of pulling, it is an easy matter to work it out into the palm of the hand.

It is hardly necessary to remark that the trick may of course be worked with a half-dollar, dime, or quarter, just as well as with a cent. Two or three coins may be pulled through the handkerchief at the same time as easily as one when once we have grasped the method to be employed.

THE MYSTERIOUS TUMBLING TABLET

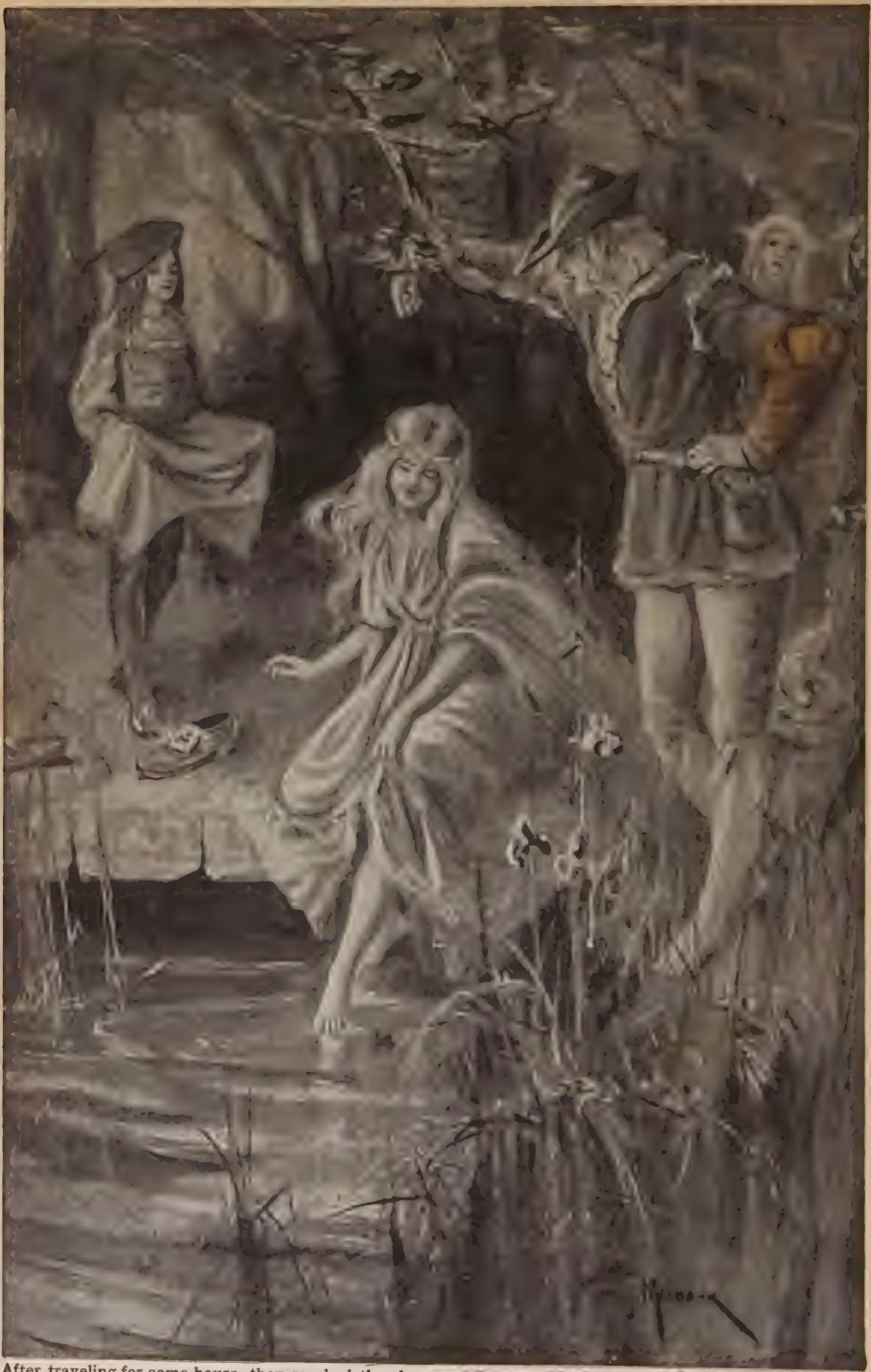
THIS is an amusing little toy that is easily made. We cut two pieces of thick cardboard, one and a half or two inches long and half an inch wide. Both of these we cut at each end to the shape of a semicircle. Now we get a strip of paper—writing-paper will do—one inch wide, and we gum it or glue it round the edges of the two pieces of cardboard, in the position shown in picture 2. That gives us a tiny oblong box, as seen in the picture. But before fixing on the paper as we have already described, we place inside the box a few round lead bullets or large shot, but not more than will lie across the box in one row. Our "tumbling tablet" is now ready to commence its performances. All that is left for us to do now is to place it on any surface with a gentle slope and give it a little start. A tray tilted just a little or a large book lifted a little higher at one end than the other, will do. Of course, we place the tumbling tablet up at the highest part of the sloping surface. Perhaps it will need a start to go off, and if so we need only roll it over once. Then it will roll over and over down the slope, looking almost as if it were alive. If we are really clever, we can easily understand why it behaves so. The balls or shots roll down the inside of the tablet until they reach the lower end, against which they bump, thereby causing the tablet to turn over. This movement lands the balls at what has become the higher end of the tiny box, and again they roll down and they will repeat the operation time after time, until they come to a stop because the bottom of the slope is reached.


1. Shape of side.

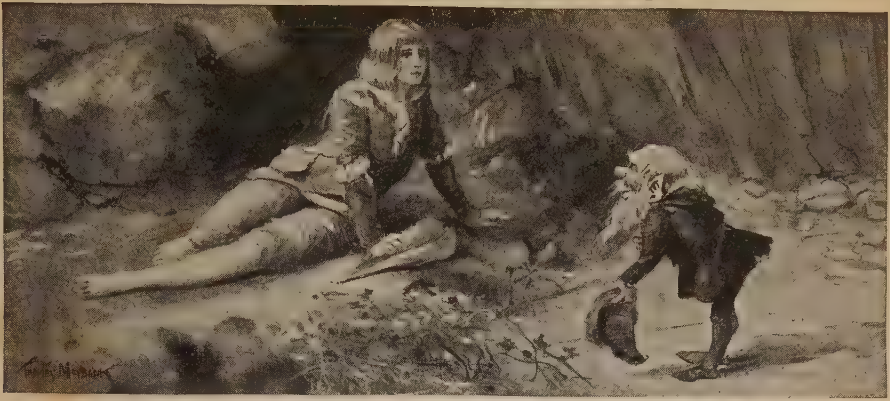

2. Complete tablet.

THE NEXT THINGS TO MAKE AND THINGS TO DO BEGIN ON PAGE 4193.

PRINCESS MAYBLOOM AT THE FOUNTAIN



After traveling for some hours, they reached the place, and Princess Maybloom pulled off her stockings and dipped her feet into the marvelous fountain. The moment her feet touched the water, they grew smaller.



THE STORY OF FAIRYFOOT

CONTINUED FROM 3881

ONCE upon a time there stood far away in the West Country a town called Stumpinghame. Stumpinghame had a king of its own, and his name was Stiffstep; his family was very ancient and large-footed. Great feet had been the fashion there from time immemorial, and the higher the family the larger were they. His queen, Hammerheel, was the greatest beauty in Stumpinghame. Her Majesty's shoe was not much smaller than a fishing-boat; and their six children promised to be quite as handsome, and all went well with them till the birth of their seventh son, when it was whispered throughout the city that the queen's seventh child had been born with such miserably small feet that they resembled nothing ever seen or heard of in Stumpinghame, except the feet of the fairies.

The king and queen were so ashamed of him that the young prince was sent secretly out to the pasture lands, to be brought up by the shepherds. The chief man there was called Fleecefold, and people came from all quarters to see the young prince.

The king and queen had given him fourteen names, beginning with Augustus; but the honest country people could not remember so many; besides, his feet were the most remarkable thing about the child, so with one accord they called him Fairyfoot. He was a handsome boy, but the news of the court traveled to the shepherds, and Fairyfoot was despised among them. Fleecefold was ashamed to have him in his cottage, and as soon as he was old enough, Fairyfoot was sent every day to watch some sickly sheep that grazed on a wild, weedy pasture, near the forest.

Poor Fairyfoot, who was often lonely and sorrowful, was lying in the shadow of a mossy rock one warm summer noon, when a robin, pursued by a great hawk, flew into the old velvet cap which lay on the ground beside him. Fairyfoot covered it up, and the hawk, frightened by his shout, flew away.

"Now you may go, poor robin!" he said opening his cap; but instead of the bird, out sprang a little man dressed in russet brown, looking as if he were a hundred years old. Fairyfoot could not speak for astonishment, but the little man said:

"Thank you for your shelter, and be sure I will do as much for you. Call on me if you ever want help; my name is Robin Goodfellow." And, darting off, he would have been out of sight in an instant had not Fairyfoot jumped up and called him back.

"What is it?" said the little man.

"I am very lonely, and no one will play with me, because my feet are not large enough," said Fairyfoot sadly.

"Come, then, and play with us,"

said the little man. "We lead the merriest lives in the world, and care for nobody's feet; but there are two things you must mind—first, do as you see the rest doing; and, secondly, never speak of anything you may hear or see."

"I will do that, and anything more you like," said Fairyfoot. Then the little man, taking his hand, led him over the pasture into the forest, and along a mossy path among old trees wreathed with ivy, till they heard the sound of music, and came upon a meadow where the moon shone as bright as day, and all the flowers of the year bloomed together in the thick grass. There was a crowd of little men and women, some clad in russet color, but far more in green, dancing round a little well as clear as crystal. And under great rose-trees, which grew here and there in the meadow, companies were sitting round low tables covered with cups of milk, dishes of honey, and carved wooden flagons filled with clear red wine.

The little man led Fairyfoot to the nearest table and bade him drink. Immediately the red wine touched his lips, all his troubles seemed to leave him, and the little people about the well cried: "Welcome! welcome!" and every one said: "Come and dance with me!" So Fairyfoot was as happy as a prince, and drank milk and ate honey till the moon was low in the sky; then the little man took him by the hand and led him back to his own bed of straw in the cottage corner.

Next morning Fairyfoot was not tired for all his dancing. Nobody in the cottage had missed him, and he went out with the sheep as usual; but every night all that summer, when the shepherds were safe in bed, the little man came and took him away to dance in the forest.

The wonder was that he was never tired or sleepy, as people are apt to be who dance all night; but before the summer was ended, Fairyfoot found out the reason. One night, when the moon was full, Robin Goodfellow came for him as usual, and away they went to the flowery green. The fun there was high, and Robin was in haste. So he only pointed to the carved cup from which Fairyfoot every night drank the clear red wine.

"I am not thirsty, and there is no use losing time," thought the boy, and he joined the dance; but never in all his life did Fairyfoot find it such hard work to keep pace with the company. Fairyfoot did his best, but at length he was glad to steal away, and sit down behind a mossy oak, where his eyes closed for very weariness. When he awoke, the dance was nearly over, but two little ladies clad in green talked close beside him.

"What a beautiful boy!" said one of them. "What handsome feet he has!"

"Yes," said the other, "they are just like the feet Princess Maybloom had before she washed them in the Growing Well, which has now dried up. Nothing in this world can make them small again, you know."

When they were gone, Fairyfoot could sleep no more for astonishment. It amazed him that Princess Maybloom's father should be troubled at hers growing large. Besides, he wished to see that princess and her country. All that day he was so weary that he got into sad disgrace with the shepherd for neglecting his sheep. The old man beat him so cruelly that he determined to run away.

So on and on he ran, far into the forest, until at last, utterly exhausted, he sank down at the foot of a tree and fell fast asleep. When he awoke, he heard voices.

"What boy is this?" said a nightingale on a branch above him. "He can not have come from Stumpinghame with such small and handsome feet."

"No," said another; "he has come from the West Country. How in the world did he find the way?"

"How simple you are!" said a third nightingale. "What had he to do but follow the ground-ivy which grows over height and hollow, bank and bush, from the lowest gate of the king's kitchen-garden to the root of this rose-tree?"

Fairyfoot was greatly astonished at this conversation, and thought it might be as well for him to follow the ground-ivy, and see Princess Maybloom. It was a long journey, but he found the gate at last, and walked through the garden, till a white fawn came frisking by, and he heard a voice saying sorrowfully:

"Come back, come back, my fawn! I cannot run and play with you now, my feet have grown so heavy." And, looking around, he saw the loveliest young princess in the world, dressed in snow-white, and wearing a wreath of roses on her golden hair. At once he guessed that this must be the Princess Maybloom, and made her a very humble bow.

"Royal princess, I have heard of your trouble because your feet have grown large, and I know of a certain fountain in my country that will make them smaller and finer than ever they were," said he.

When the princess heard that, she danced for joy in spite of her large feet, and she and her six maids brought Fairyfoot before the king, who consented to allow the princess to accompany Fairyfoot to the marvelous fountain.

After traveling for some hours, they reached the place, and, sitting down, Princess Maybloom pulled off her stockings and dipped her feet into the fountain. The moment her feet touched the water, they grew smaller, and when she had washed and dried them three times, they were as small and finely shaped as Fairyfoot's. There was great joy among the company, and the princess thanked Fairyfoot again and again.

Just at that moment they heard a sound of music, and Fairyfoot knew it was the fairies going to their dancing-ground. Rising quickly, he took the Princess Maybloom by the hand, and all followed the music through the forest. At last they came to the flowery green. Robin Goodfellow welcomed the company for Fairyfoot's sake, and gave everyone a drink of the fairies' wine. So they danced there from sunset till the grey morning; but, before the lark sang, Robin Goodfellow took them all safe home.

There was great joy that day in the palace because Princess Maybloom's feet were made small again. The king gave Fairyfoot all manner of fine clothes and rich jewels; and when they heard his wonderful story, he and the queen asked him to live with them and be their son.

In the course of time Fairyfoot and Princess Maybloom were married, and they both lived happily ever after.

THE DOG THAT KNEW HIS MASTER

A TRUE TALE OF A SCOTTISH COLLIE

GOILA was a Scottish collie, born on a sheep-farm near the picturesque banks of Loch Goil. Hence the name by which, by a child's happy freak, he was called. His parents were of high degree on both sides, and had won prizes on the show-bench and in the trial-field.

When full grown, Goila was a perfect type of animal grace. The head was poised on a long, arched neck; the back broad, with an upward curve in the loins; the quarters muscular; the shoulders well set back and powerful; the legs rather high and never tiring; the body, except the deep chest, which boasted a snow-white "shirt-front," was covered with the glossiest blue-black coat, which one could feel was impenetrable to the sharpest cold; and the tail was large and bushy—a true flag-signal in frolic, peace, or war.

But it was the head itself which won love and admiration: a broad skull, flanked by small, forward-drooping ears when quiet, but instantly erect when alert; the muzzle was smooth, fine, and tapering, and a white line ran down the forehead; the eyes were full, bright, expressive, spirited, and intelligent. Goila grew up more than a pet. With the children he was a comrade in fun and play; with the head of the household he was a friend and companion in the best sense of the term.

Early in puppyhood, Goila showed musical tastes. In the parlor was an upright piano, and it was noticed that Goila if he possibly could get access to the room, lay beside the pedal just below the keyboard.

By and by, as his musical education progressed, so did his likes and dislikes in harmonies.

When some compositions were being played, he became almost frantic, running round the room, barking angrily. Others seemed to please him; and he would crouch down on the carpet and emit a prolonged cry, which rose and fell with a distinct cadence. He was a loyalist: he invariably joined in with fervor, and not out of tune, when the children sang "God Save the King."

One day, when it was known that there was no person in the parlor, notes were heard coming from the piano as if someone were striking the keys at random. When the door was opened, Goila was found standing on his hind legs, with his two fore-paws pressing here and there on the keys, the response from which was evidently to his intense delight. The hint was enough.

The children taught him, with assistance, of course, to pick out "Haydn's Hymn" not at all badly He was a religious doggie, as he never ventured to utter a note during the Sunday evening hymn. But the greatest fun was when a German band came round to the street. The moment Goila heard the toot-toot, he ran to the band with the keenest enjoyment. He jumped round the somewhat resentful musicians, howled and pranced approval or otherwise, and if, perchance, which was often the case, an inexpert or careless instrumentalist played a wrong note, Goila rushed at his heels. In fact, he became so unwelcome a critic that the band very soon ceased to come to the street.

THE DOG STOPPED AND PRICKED HIS EARS

He had social instincts. His most curious friendship was that with a tortoise. When the tortoise became accustomed to the dog, it put out its head from its shell, and allowed Goila to lick it. There was a step leading from the kitchen to the scullery, and another from the scullery to the back garden. When the tortoise wished to take its walks abroad, Goila would carefully assist it down the steps, and watch it with curious interest searching for and eating lettuce. But Goila's love for his mailed friend was the undoing of the latter. When autumn came, the tortoise dug a hole in the garden soil in which to sleep through the winter. Goila smelt him out, and excitedly rescued his friend from premature burial. From cold and want of his winter sleep the tortoise died.

Goila was a wonderful retriever either of children's boats or caps on the lake, or of articles artfully hidden in holes or beneath stones. He had cunning distinctions as to what was fair game. Early in the morning after a first day's stay in the schoolhouse of a Highland village, Goila was found to have brought to the kitchen door a rabbit and a partridge. We wished to live at peace with the gamekeeper, and solemnly admonished Goila never to bring in another bird; we soothed our conscience by telling the dog that rabbits were vermin. Never another bird was found on the doorstep; but, truth to tell, there was occasionally rabbit-pie for dinner.

How long does a dog's memory remain fresh? It is hard to say. The writer had occasion to go abroad Although Goila was supposed to be locked up when he left home to take the train for London, the dog came tearing along the departure platform as the guard gave the signal for the start, and was last seen galloping at a great speed and howling furiously as the train disappeared in the darkness of the night. Some days afterwards he returned home, footsore and with a ragged coat. The dog was disconsolate; he lost all interest in his old home and its inmates, and after a few weeks disappeared. Seven years elapsed, and the writer returned to Scotland. One afternoon, a month afterwards, in the southern district of his own town—Edinburgh—he saw Goila trotting at the tail of a butcher's cart. Merely on the offchance of a recognition, he called out: "Goila!" The dog stopped, pricked up his ears, gave a wild yelp of delight, circled round and round, leaped up with his fore-paws on the shoulders, and licked the dearly-loved face of his old master.

But the new joy was very short-lived. Before many months had gone Goila had again disappeared, as if it had all been a dream; and, despite every inquiry by advertisement and otherwise, he was, to our great sorrow, heard of no more.

UNDINE, THE STORY OF A WATER NYMPH

ONCE upon a time, many years ago, there lived an old fisherman and his wife. They were lonely people, for their bit of land lay upon the edge of a large lake, while back of it stretched an enchanted forest through which lay the road to the market where the old man sold his fish. To their great joy, it came to pass that a child was born to them, a beautiful little girl. One day as the mother sat by the edge of the lake, her baby in her arms, the child, attracted by some beautiful thing in its clear depths, leaped forward into the water, sank instantly below its surface and was gone. That same evening, while the parents were mourning the loss of their child, a tap came at the cottage door and a lovely little girl about three or four years of age stood upon the threshold.

The fisherman and his wife took her in gladly and brought her up as their own daughter. When the girl was about eighteen years old, there came through the enchanted forest to the old fisherman's hut a wonderful knight named Huldbrand. He had made his way through the gloom and mysteries of the forest with great difficulty. Horrible little dwarfs had tried to frighten him away; a great tall man, with flowing robes, had continually blocked his path.

Hardly had the knight reached the shelter of the cottage when a great storm came up which lasted several days. The waters of the lake rose to such an extent, that the little promontory where the old couple and their foster daughter lived became an island and all passage out into the world beyond was cut off. During this time the lovely Undine and the handsome knight were very much together, and became very fond of each other.

One night while the storm was still raging, a priest, who had been driven to their shore by the fury of the waves, sought the protection and shelter of the little cottage. The good father soon became aware of the attachment of the young couple, and before the evening was over it was arranged, much to the joy of her foster-parents, that Undine and the knight should be joined in holy wedlock.

Now it happens, as perhaps you've heard, that the air and elements among which we live are inhabited by beings as wonderful as ourselves, and far more beautiful. Especially are the seas and rivers, and even the little brooks, full of these lovely beings, so like us but with this great difference, that they have no souls. Therefore, when they die they vanish into dust, leaving no trace behind, and have no hope of a more beautiful after life. To find a soul it is necessary for one of these lovely creatures to become united to one of our race, and it was for this purpose that Undine's father, a great prince of the Mediterranean Sea, had sent his little daughter to the fisherman's cottage that night so long ago.

When Huldbrand became aware of this fact he was at first dismayed but Undine was so lovely, and indeed since the night of the wedding so changed, so gentle, so biddable, that he dismissed his fears, and clasping her to him, vowed eternal love and protection. The morning after the wedding found the sun shining gloriously and the waters so far receded that there was no longer need of delay. So, accompanied by Father Heilmann—Undine mounted upon the knight's horse, Huldbrand walking at her side—they started back through the enchanted forest.

The sudden departure and long disappearance of the young knight Huldbrand had caused great consternation among his friends in the royal city, and great, therefore, was the rejoicing at the return of the knight, accompanied by his beautiful bride. There was one, however, who could not rejoice. This was Bertalda, foster-child of the Duke and the Duchess of the imperial city; for she it was who had sent the knight into the enchanted forest as a test of his love for her. So there was, as you can see, nothing but jealousy in her heart for the young bride who had won his love at the other end of the dark forest. For Bertalda, however, Undine soon felt the greatest affection, and when she discovered from her uncle Kühleborn, a powerful water sprite, who inhabited the waters of that region and with whom she had frequent intercourse, that Bertalda was no other than the lost daughter of the old fisherman and his wife, her joy knew no bounds.

Thinking in her innocent heart to give

Copyright, 1911, 1918, by M. Perry Mills.

a delightful surprise, she planned a dinner, at the end of which the secret of Bertalda's birth, which up to that time had remained a mystery, was to be revealed. At the appointed time the old fisherman and his wife were led into the dining hall and Undine, with every mark of affection and delight at giving so much happiness, proclaimed them Bertalda's long lost parents. Bertalda, however, who never for an instant had dreamed but that some lady of high rank would claim her as her child, was enraged at what she considered an attempt to humble her in the eyes of Huldbrand and all his guests. She treated the poor old couple so discourteously that the Duke and Duchess withdrew their protection and her own parents refused to accept her as their child until she should show a change of heart, and in habit befitting her lowly birth come to them alone through the enchanted forest as proof of her regard.

Feeling that the disastrous results of her plan must have made the city forever distasteful to Undine, Huldbrand decided to start the next morning for Castle Ringstetten, situated near the source of the Danube River. As they drove out of the city they encountered Bertalda in the costume of a fisher-maiden, forsaken by every one, trying to sell her fish as means of a livelihood.

At sight of Bertalda's misfortune, Undine was full of sympathy and would hear of nothing but that Bertalda should accompany them on their journey and that they should share all things as sisters in love and affection. For a time all went well at Castle Ringstetten, but gradually Bertalda lost her suddenly acquired humility; she became again the proud and haughty lady, and encouraged by the admiration which Huldbrand no longer strove to conceal, she frequently assumed the position which Undine as rightful lady of the castle should have held. Kühleborn, ever watchful for the welfare of his niece, became aware of her unhappiness and by his frequent visits and sudden appearances in the castle frightened Bertalda and added to the knight's growing aversion to his gentle wife. At last, in order to prevent the reappearance of her mysterious relative, Undine ordered the great fountain in the courtyard of the castle to be sealed up. For a time again all went well, Huldbrand felt a return of affection for his trusting wife, and secure in their new found happiness, Undine suggested a much talked of trip down the Danube as far as Vienna. Bertalda of course was to accompany them and they began to plan their journey with great delight.

Undine had often warned her husband against showing any trace of anger or displeasure toward her while on the water, but no sooner had they entered the domain of the watchful Kühleborn than they were tormented by his impish tricks. Undine had constantly to rebuke him for his insolence, and their pleasure was completely spoiled. Kühleborn's mischievous pranks became more and more violent, until in a flash of rage, Huldbrand commanded his trembling wife to return to her mysterious kindred of the sea and trouble him no more. In the greatest distress Undine began to weep. "Alas," said she, "farewell. They shall do you no harm, only remain true so that I may be able to keep them from you. I must, alas, go away! Oh, woe, woe, what have you done! Oh, woe, woe!" She vanished over the side of the vessel and disappeared from sight, but it seemed as if the little waves kept saying, "Oh, woe, woe; remain true; woe, woe!"

The Lord of Ringstetten and Bertalda returned alone to the castle and for some time lived in mourning and great sorrow, thinking only of their love for Undine and forgetting entirely their feeling for each other. But as often happens, gradually the knight's sorrow grew less. He thought less often of Undine and more often and with still greater fondness of Bertalda. At last the nuptial day was set, and Father Heilmann was summoned to perform the ceremony. Upon receiving the summons, the priest immediately set out for the castle, not indeed to perform the marriage rite, but if possible to prevent it, for Undine had appeared to him in a dream imploring him to prevent the marriage, and thus to save Huldbrand's life, for she was still alive. In spite of Father Heilmann's advice, preparations for the coming festival went on according to arrangement, and indeed, all might have been well had not Bertalda bemoaned the fact that the fountain, from which such healing waters used to flow, had been sealed up. One of her maidens, hoping to please her new mistress, hastened to summon attendants to lift the stone from the fountain. The task proved an easy one, for scarcely had they touched it when, as if impelled by some hidden power, the great stone rolled away, and from the opening of the fountain rose a female figure draped in white. Weeping bitterly and wringing her slender hands, the sorrowful figure glided silently through the courtyard and up the stairs to the knight's own room, where he stood lost in gloomy melancholy.

He was pondering in his heart the meaning of a dream he had had the previous night. It seemed to him a dream, but his spirit had in reality been translated to the Mediterranean Sea, where Undine now dwelt. He could see her sitting beneath a crystal arch weeping bitterly. Presently her uncle Kühleborn approached her and, as if to warn him anew, they talked of the danger he would incur by leaving his castle or opening the fountain, should he indeed marry Bertalda. "But," said Undine, "I have prevented that, for he is now in spirit hovering over the sea, listening to our conversation, and he will remain true to me." And ever and anon through his dream floated the exquisite music of the Swan Song, symbol of death.

But now, in spite of all warning, he had broken his vow of faith and love and Undine had been sent to perform her mournful task. "They have opened the spring and you must die," she said very gently. Paralyzed with terror and the certainty that his end had come, Huldbrand nevertheless felt his breast swell once more with love for this beautiful creature, for raising her veil, Undine appeared before him fair as when he had wooed her beyond the enchanted forest.

Drawing him to the couch, she laid her head against his breast and encircling him with her arms she wept and wept until he, too, began to weep, and finally exhausted sank back upon the pillows dead. "I have wept him to death," she said to a group of maidens as she passed.

They buried him in a little country churchyard near the castle. In the funeral procession was a white-robed figure that wept unceasingly. When the mourners knelt, it knelt too, but when the rest arose, the white figure had vanished and in its place gushed forth a little silver streamlet that gradually encircled the knight's grave and continues to do so this very day.

LA PLUS SAGE FILLE DU WESSEX

THE ENGLISH VERSION OF THIS STORY IS GIVEN ON PAGE 2316

Il y avait autrefois un Roi de Wessex appelé Ina. Il était grand, brave et beau, mais avait un grand défaut. La moindre des choses le vexait et le mettait dans une colère terrible. Le sachant, il décida d'épouser une fille sage qui pourrait le calmer et le diriger. Une après-midi, il quitta Winchester et alla dans la grande forêt, à cheval. Ayant soif, il s'arrêta à la cabane d'un bûcheron pour boire du lait. La jolie fille du bûcheron lui apporta du lait et quand il lui rendit le gobelet, il lui dit:

"Je suis le Roi de Wessex, Ina. Videz toutes les mers du monde avec ce gobelet et je vous ferai ma Reine."

Edith entra dans la cabane, en ressortit avec une poignée d'étoupe et la tendant au Roi Ina, elle s'écria gaiement:

"Barrez toutes les rivières avec cette étoupe et j'obéirai à votre désir."

"Vous êtes celle que j'ai cherchée," dit le Roi Ina.

Et il la mit sur son cheval et la conduisit à son palais de Winchester. Mais juste avant le mariage, Edith lui dit:

"Vous savez que vous avez l'humeur ombrageuse. Promettez-moi donc, si vous vous fâchez avec moi et me chassez du palais, de me laisser emporter un cadeau d'adieux."

Le Roi Ina y consentit, naturellement. Comme ils étaient à souper, un soir, Ina fut offensé par un bon conseil que sa femme lui donna, et s'écria:

"Vous vous mêlez trop de mes affaires. Demain, vous retournerez avec votre père à votre cabane."

Quand son mari eut le dos tourné, elle versa une potion dans son breuvage, ce qui le fit s'endormir. Ensuite, elle le fit transporter doucement à la cabane dans la forêt.

"Qui m'a conduit ici?" cria-t-il en s'éveillant le lendemain matin.

"C'est moi, chéri," dit la Reine Edith. "Vous êtes mon cadeau d'adieux."

"Ah!" dit le Roi Ina en l'embrassant, "j'ai eu raison d'épouser la plus jolie fille du Wessex, at aussi la plus sage!"

THE FABLES OF ÆSOP THE SLAVE

THE PEACOCK AND JUNO

A PEACOCK, feeling one day very discontented, said to the goddess Juno: "Why did you not give me such a good voice as the nightingale? Everyone is pleased to hear its voice, whereas I am laughed at for the ugly, screaming noise that I make."

Juno, who was very much concerned at the discontent of her favorite bird, replied:

"True, the nightingale has a fine voice, but you have the advantage in your beauty and elegance."

"But what is the use of my silent beauty when I have such a poor voice?" demanded the peacock.

Juno dismissed him, saying:

"Each creature has some of the good things of Nature. This one has beauty, that one a glorious voice, another strength, and so on, and each should be content with its particular quality."

Be content with what you have.

THE FOX AND THE FROG

A FROG one day told the various animals in the forest that he was able to cure all kinds of illness. He spoke in a hoarse croak that was little understood, and the animals therefore admired his learning, and believed what he said. A fox, however, who happened to be passing at the time, said, with indignation:

"How can you have the impudence to offer to cure others, when you have such an ugly spotted body and horrible croaking voice?"

People should cure their own faults before finding faults in others.

THE HEN AND THE FOX

A HUNGRY fox went into a fowl-house in search of something to satisfy his appetite. He saw, sitting on a perch, a fat hen; but, try as he would, he was unable to reach her. At last he thought of trying to make her descend from her position.

"Cousin hen," said he, "I heard that you were ill, and so I have come to inquire how you are now. Come down, and I will feel your pulse, and tell you what to do to get better."

"True, I am not feeling very well," answered the hen; "but I am sure that I should catch my death if I happened to come down from this cozy perch."

Flattery is the last resort of fools.

LE ROI, LE NOBLE, ET LE PAYSAN

THE ENGLISH VERSION OF THIS STORY IS GIVEN ON PAGE 3711.

LOUIS XII. de France apprit un jour qu'un certain noble avait très brutalement châtié un paysan. Comme le Roi était appelé le "Père du Peuple," et était vraiment adoré de tous ses sujets à cause de sa bonté de cœur, on peut s'imaginer combien il dut être irrité et désolé. Il résolut de donner au noble une leçon sur la façon de traiter ceux qui étaient moins fortunés que lui, mais il ne révéla pas son plan. Pendant plusieurs semaines il réfléchit et à la fin il trouva un plan qui, selon lui, devait être excellent.

Un jour, il invita le noble à son palais et le garda à dîner. Il ne dîna pas avec son hôte, mais fit servir au seigneur un banquet magnifique. Tout ce qu'on peut imaginer de meilleur à manger fut servi, excepté du pain, car le Roi avait donné l'ordre absolu que l'on ne serve pas de pain. Le noble fut naturellement surpris par cette omission, mais, par courtoisie, n'osa pas demander une chose aussi petite et commune, en présence de tant de mets rares et délicats. Mais de plus en plus il sentit le manque de pain, tant que vers la fin du repas, il était presque enragé par l'absence d'une chose aussi nécessaire.

A ce moment le Roi entra.

"Monsieur," dit le Roi à son hôte, "vous a-t-on servi un bon repas?"

"Sire, répondit le noble, "on m'a servi un festin superbe, un festin de Roi. Et cependant, pour dire à Votre Majesté toute la vérité, il me semble que je n'ai pas bien dîné; car, pour vivre, le pain est nécessaire, et il n'y avait pas de pain à ce banquet."

"Allez," dit Louis XII., sévèrement; "et comprenez bien la leçon que j'ai désiré vous donner. Puisque vous avez besoin de pain pour vous satisfaire, apprenez à traiter plus humainement ceux qui travaillent pour le faire pousser, afin qu'on vous le serve."

THE NEXT STORIES ARE ON PAGE 4123.

TTCo
226
THE TEXAS COMPANY

HOW WE GET KEROSENE

CONTINUED FROM 4011

UNLESS your house is furnished with gas or electric lights, you probably have lamps which burn kerosene. A majority of the people still use the light of kerosene lamps, as gas and electricity are seldom supplied except in cities or towns. Candles are troublesome and expensive, and acetylene gas requires some care.

WHAT DO WE MEAN BY KEROSENE?

Now kerosene is only one of the many products of petroleum. This last word means "rock oil," and was once thought to be mineral in its origin. Now we know that it is closely connected with coal and is usually found in its neighborhood. Petroleum has been known in Asia and Europe for thousands of years, but it is only recently that kerosene came into use. Your grandfather can no doubt remember when it first was offered for sale.

HOW PETROLEUM WAS FIRST OBTAINED

The early explorers of what is now the United States found petroleum oozing out of the ground or floating on the surface of the water, in many places. They found that the Indians rubbed their bodies with it, and said that it made them active and quick. So when the country became settled the whites also began to use it in a small way. Sometimes they laid blankets on the ground where the oil appeared and then wrung it out of them. Sometimes they skimmed it off the surface of the water. The quantity they gained was small. It was then sold by pedlers at a high price, as Seneca Oil, Indian Oil, or some such name. It was rubbed on the body as a cure for rheumatism, or taken as a medicine. Few families would use more than a pint in a year.

The men, boring wells to get salt water in Western Virginia in 1806, found much petroleum along with the brine. This caused a great deal of trouble here and at other places, but no one seems to have thought of using it except as a liniment or as a medicine for many years. Finally in 1848 Samuel M. Kier had some of the thick substance distilled and secured an oil which would burn in a lamp, though it had a horrible odor. It was called carbon oil and sold for a dollar and a half a gallon.

Now people began to sink wells to get the petroleum, but the natural

Copyright, 1911, 1918, 1921, by M. Perry Mills.

gas which sometimes appeared with the oil caught fire and caused an explosion. The oil was now sometimes used to make machinery run more smoothly, but still the business did not grow rapidly, as there was plenty of animal oil for this purpose.

THE FIRST APPEARANCE OF THE WORD KEROSENE

In 1846 Dr. Abraham Gesner, of Nova Scotia, obtained an oil from coal which he afterwards called "kerosene," and a company was organized to manufacture it. The company was successful and other oil-works were established. The demand grew and Doctor Silliman, of Yale College, was employed to find out whether there was any likeness between coal-oil and petroleum. He conducted his experiments on Oil Creek in Pennsylvania and reported that petroleum furnished excellent oil for burning. Samuel M. Kier had sold some oil for burning in 1848 and two years later James Young, an Englishman, got some oil from shale which would burn.

People began to want more of this oil, and in 1856 it was determined to try the experiment of boring a well deep into the earth. The company employed Edwin L. Drake to superintend the work. This man had been a railway conductor, who had resigned because of ill-health. A new company was organized, and, finally, in 1858, Colonel Drake, as he was called, though he had never been a soldier, arrived in Titusville, Pennsylvania, and tried to begin boring the well. Tools could not be had, and not until May, 1859, did work really commence. A tube was driven down to the rock and the workmen began to drill, accomplishing about three feet a day.

HOW THE FIRST WELL WAS SUNK

Money was scarce and at one time it was thought that the work must be given up, but Colonel Drake was determined to go on and borrowed the money necessary to keep the drillers at work. On Saturday, August 28, 1859, the drill seemed to move easily just before the workmen stopped for the day. Sunday, one of them visited the well and found that it was nearly full of oil.

TOWNS IN THE OIL REGION SPRING UP IN A NIGHT

A pump was attached on Monday and the well was found to yield twenty barrels a day. The whole region went wild. Every foot of land along the creek was bought or leased by men who intended to drill for oil. Wells were sunk in every direction. The town grew in a few months from a population of a few hundred to fifteen thousand. Many men grew rich almost at once. The news spread and men in other sections where oily springs had been found also sunk wells.

THE LAST DAYS OF COLONEL DRAKE SPENT IN POVERTY

The Drake well did not last many years. Gradually the yield grew less and less, and finally gave out altogether. Colonel Drake had thought that it would be permanent and did not try to buy or lease other land. Finally he left the oil regions with $16,000, which he afterward lost, and for a time was very poor. When the men who had gained millions in the oil business heard of his poverty, they raised some money for him and the legislature of Pennsylvania voted $1,500 a year as long as he or his wife should live.

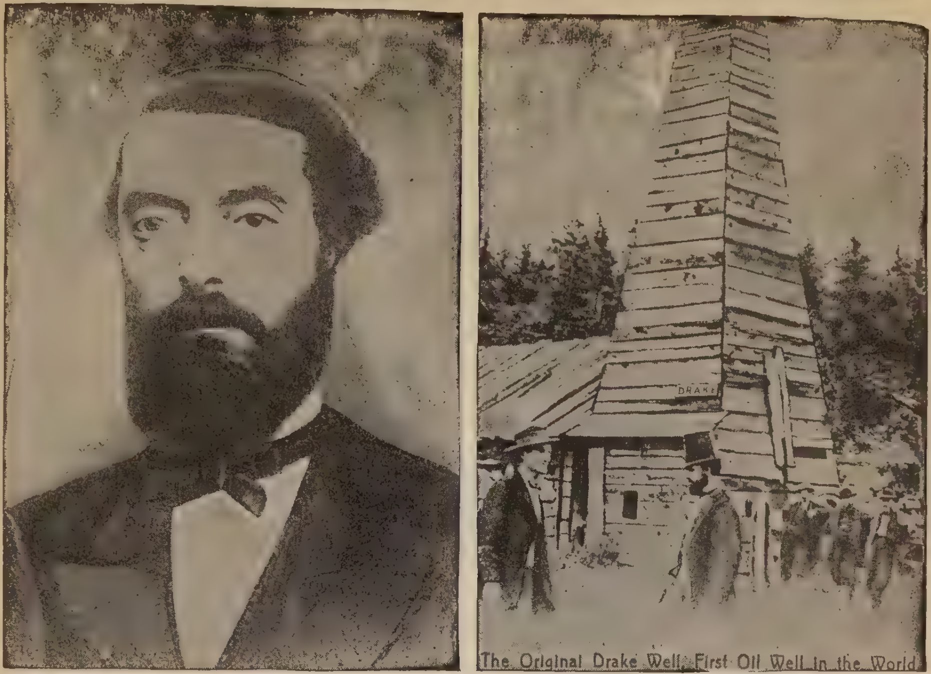
In other sections a different kind of oil was found. This was thick like molasses, and was used only to make machinery run more smoothly, and today the wells in the Franklin district send their oil over the world. A third kind of oil, which could be used both for light and machinery, was soon discovered. Some of the wells spouted oil. Soon refineries were established to separate the oil into its different parts.

A MATCH SOMETIMES CAUSES A FIRE

Many accidents occurred in the oil country in the early days. Much oil was wasted and ran out in the ground. Every building around an oil-well was saturated, and when a match was carelessly thrown down, sometimes a great fire occurred. Occasionally a tank was struck by lightning. We show you a picture of that accident. Now more care is taken and fewer accidents occur.

For years Pennsylvania furnished most of the oil used in the world, but later oil was found in many other states. The United States still furnishes much more than half of all the oil produced in the world. Now the leading states are Oklahoma, California, Kansas and Texas, but others furnish large quantities. Many countries produce large quantities of oil, and the world requires more and

EARLY DAYS IN THE OIL INDUSTRY


DRAKE
The Original Drake Well, First Oil Well in the World

This man, Colonel Edwin L. Drake, drilled the first well for oil near Titusville, Pennsylvania, in 1859, and with this well, which you see to the right, the great American oil industry began. Before this time oil had been used chiefly for medicine or as a liniment, though a little had been used for lighting purposes.

Shooting an Oil Well

Here is an oil well which has just had a charge of nitro-glycerine exploded at the bottom. The picture to the right shows a burning oil-tank, which was struck by lightning. When a tank catches fire, it must burn until the oil is exhausted. as water only spreads the flames. Sometimes oil on the surface of water catches fire. Pictures copyright by Keystone View Co.

more every year. Mexico, Russia, the Dutch West Indies, Rumania, India and Persia are now important sources of oil, and the search continues in every country where there is a chance of success.

Though Canada has been producing a little oil for many years, chiefly from Ontario, recent discoveries promise a much larger amount in the future. Alberta seems particularly promising, and some rich wells have been bored around Fort Norman, in the North West Territories, within the Arctic Circle. Getting the oil to market is a serious question here.

WHAT IS MEANT BY "TORPEDOING A WELL"

In the days when wells were drilled for salt water, it was found that by exploding powder in the bottom of the well, sometimes more water could be secured. The same experiment was tried with the oil-wells and was often successful. At first powder was used, but it was soon found that nitro-glycerine was better. This substance is a mixture of nitric and sulphuric acids, and glycerine, and is very powerful. A few drops will wreck a house if it is struck sharply. It does not always explode from fire. It is let down into a well and a little powder is put in a cap on top. Then a little iron weight is dropped. The explosion shatters the rocks in the bottom and cleans out the paraffine which had clogged the well. Sometimes wells which had before furnished only a few barrels a day, yielded hundreds after an explosion of this kind.

In order to increase the flow of an oil-well, a charge of nitro-glycerine is often exploded at the bottom. Here we see the men pouring the fluid into a tin cylinder. It is then carefully let down to the bottom, and then a weight is dropped down the tube. The resulting explosion often sends a fountain of oil high into the air, as you can see on another page. Sometimes the flow is permanently increased, but often the greater production does not last. Photograph copyright by Keystone View Co.

One trouble which developed was the cost of carrying the oil. The roads were bad and the teamsters charged high prices for carrying the oil. Then too the barrels were expensive and not many of them could be carried on a freight car. So wooden tanks were built upon the cars, and then iron tanks like a boiler were built. Every stream had a fleet of flat boats which carried oil to market.

SENDING OIL TO MARKET UNDER THE GROUND

Only a year or two after the oil-wells were opened a man thought of the plan of running the oil to market in a pipe. The teamsters, angry at seeing their business broken up, destroyed the first pipes and sometimes there were riots. But the new plan saved so much expense that others were built and now there are thousands of miles of pipes running from the oil-wells to the refineries, or to the sea coast, not only in the United States but in other oil-producing countries.

Every few miles are powerful pumps which drive the oil onward. Sometimes the paraffine collects on the sides of the pipes and almost clogs them up. When this happens a little machine with sharp, revolving knives is put into the pipe. The pressure from behind pushes it along and the inside of the pipe is scraped clean. This is usually called a "go-devil."

Oil is exported in large ships called tanks. These ships are built with reservoirs to hold the oil, and in many of them the engines use for fuel some of the oil that they carry. Kerosene is also sent all over the world in tightly closed tin cans which are known from the farthest north to the farthest south that people live.

WHERE DOES PETROLEUM, OR ROCK OIL, COME FROM?

But, you ask, how was the oil made, and where does it come from? Are there wells or reservoirs, below the ground, in which it is held imprisoned? We shall answer the last question first by asking you to make a simple experiment. Take a piece of hard cardboard, or a bit of pumice stone or hard clay, or piece of soft stone, if you can find it. Pour a few drops of oil on the object, whatever it may be, and see what will happen. As you watch, the oil will disappear, leaving only an oily spot where it has been. The oil has not evaporated, however, as water would do. The object on which it has been lying is porous, and the oil has sunk into the pores and saturated them. If you could put pressure enough upon the object with which you are making the experiment you would get the oil back again. This will help you to understand the answer to your question. In most of the oil regions great masses of porous sandstone have been saturated with it, in others it is held by shale.

How it was made no one can definitely say. Most geologists say that both oil, and natural gas, which is often found near it, came from great masses of decayed vegetation, and fish and other forms of sea life which were overwhelmed and buried deep by some natural convulsion in the days when the world was being made into its present shape. There are other theories also; but the truth is that how petroleum was made is one of the secrets of nature which man has not yet been able to discover. Neither can we tell why when a well is sunk the oil should rush up the pipe and gush out.

Oil that is obtained from shale does not flow in wells. To obtain the oil the shale is mined like coal and is crushed, and heated in retorts, and the oil is distilled in something the same way that gas is distilled from coal. Nothing like the heat used to distil coal is needed, however.

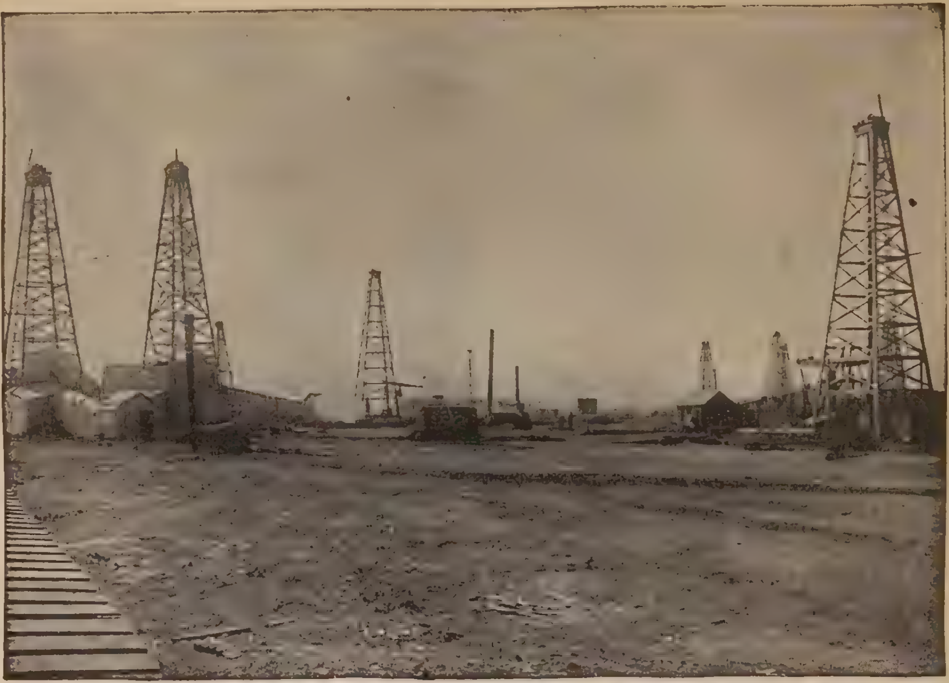
The crude oil as it comes from the wells is very different in different places. It is not one substance, but a mixture of many different things. The oil from some wells is quite light in color, in some it is amber-colored, and in some it is almost black. Different things can be obtained from the oil that comes from different wells.

THE WONDERFUL PRODUCTS OF PETROLEUM

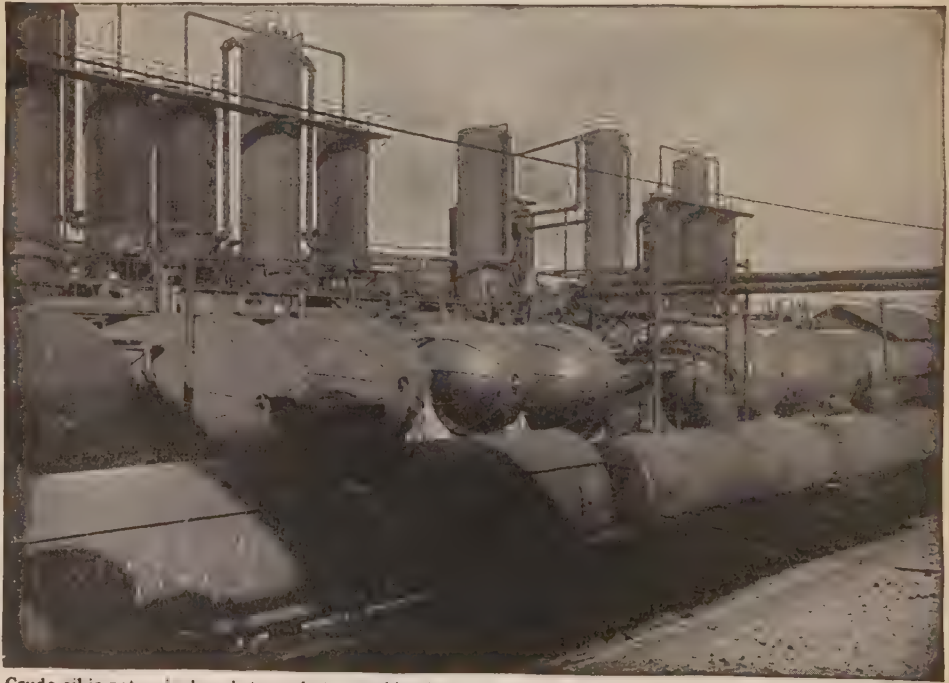
In the refineries, the crude oil is treated. Most oils will burn without refining, and some engines have been arranged to burn crude oil instead of coal. Many ships use oil instead of coal, and as we have learned in the story of gas, large quantities of oil are used to make gas.

Oil is refined, in huge stills, by heat, which reduces it to vapor or gas, and causes the different things of which it is composed to separate from one another. Many different substances are obtained from it. The kerosene and gasoline that we know so well, and oil for machinery are the most valuable, but many other products come from it. Vaseline, benzine, soap, white wax for candles and other things, lamp-black, salves, medicines, and chewing gum are only a few of the things that come out of the oil. Over two hundred things have been obtained from crude oil, and chemists think they can separate many more.

FROM THE OIL WELLS TO THE REFINERY



This corner of a Middle Western oil field shows the high derricks, like narrow pyramids. These are built first to operate the drills which drive the well deep down through earth or rock, and are retained as a part of the pumping apparatus. Some wells send a stream of oil high into the air, but deep wells usually require a pump to bring it to the surface. The tanks hold the oil until it is sent away.



Crude oil is not a single substance but a combination of many. These are separated in refineries by applying different degrees of heat. Low heat turns the lighter parts to vapor, which becomes liquid again in a condenser. This is a naphtha still. This word is sometimes used to mean a particular oil, and sometimes to include naphtha itself mixed with still lighter oils. See the tank cars on the railway in the foreground.

A GREAT POEM BY ROBERT BURNS

ROBERT BURNS, the greatest of Scottish poets, did not write many poems of any length, most of his writings being in the shorter form of songs, in which class of poetry none has excelled him. One, and perhaps the most beautiful, of his few longer pieces is that here given. "The Cotter's Saturday Night" describes, with the purest admiration, a domestic picture of Scottish humble life which is probably as true to-day as it was in the time of Burns. The simple joys of the poor, the virtues of the lowly people, have ever been worthier of admiration than the gilded pleasures of the rich. In nothing that Burns wrote can we better observe the warm-hearted nature of the poet than in this poem in praise of these qualities, which not only make for the happiness of individuals, but for the power and patriotism of nations. The first verse of the poem is really an inscription to a certain Robert Aiken, who was one of the earliest friends of Burns, and whose memory is thus enshrined for ever.

THE COTTER'S SATURDAY NIGHT

CONTINUED FROM 3996

My lov'd, my honour'd, much respected friend!
No mercenary bard his homage pays;
With honest pride I scorn each selfish end,
My dearest meed, a friend's esteem and praise.
To you I sing, in simple Scottish lays,
The lowly train in life's sequester'd scene;
The native feelings strong, the guileless ways;
What Aiken in a cottage would have been;
Ah! tho' his worth unknown, far happier there, I ween.

November chill blaws loud wi' angry sough;
The short'ning winter day is near a close;
The miry beasts retreating frae the pleugh:
The black'ning trains o' craws to their repose.
The toil-worn cotter frae his labour goes—
This night his weekly moil is at an end—
Collects his spades, his mattocks, and his hoes,
Hoping the morn in ease and rest to spend,
And weary, o'er the moor, his course does hameward bend.

At length his lonely cot appears in view
Beneath the shelter of an aged tree;
Th' expectant wee things, toddlin' stacher thro'
To meet their dad, wi' flichterin' noise an' glee.
His wee bit ingle, blinkin' bonnily,
His clean hearth-stane, his thriftie wifie's smile,
The lisping infant prattling on his knee,
Does a' his weary carking cares beguile,
An' makes him quite forget his labour an' his toil.

Belyve the elder bairns come drapping in,
At service out, amang the farmers roun';
Some ca' the pleugh, some herd, some tentie rin
A cannie errand to a neebor town:
Their eldest hope, their Jenny, woman grown,
In youthfu' bloom, love sparklin' in her e'e,
Comes hame, perhaps to show a bra' new gown,
Or deposit her sair-won penny fee,
To help her parents dear, if they in hardship be.

Wi' joy unfeign'd brothers and sisters meet,
An' each for other's welfare kindly spiers:
The social hours, swift-wing'd, unnotic'd fleet;
Each tells the uncos that he sees or hears.
The parents, partial, e'e their hopefu' years,
(Anticipation forward points the view):
The mother, wi' her needle an' her shears,
Gars auld claes look amaist as weel's the new;
The father mixes a wi' admonition due.

Their master's an' their mistress's command
The younkers a' are warned to obey,
An' mind their labours wi' an eydent hand,
And ne'er, tho' out o' sight, to jauk or play:
"An' oh, be sure to fear the Lord alway,
And mind your duty, duly, morn an' night!
Lest in temptation's path ye gang astray,
Implore His counsel and assisting might!
They never sought in vain that sought the Lord aright!"

But, hark! a rap comes gently to the door.
Jenny, wha kens the meaning o' the same,
Tells how a neebor lad cam o'er the moor,
To do some errands, and convoy her hame.
The wily mother sees the conscious flame
Sparkle in Jenny's e'e, and flush her cheek;
Wi' heart-struck anxious care inquires his name,
While Jenny hafflins is afraid to speak:
Weel pleas'd the mother hears it's nae wild worthless rake.

Wi' kindly welcome Jenny brings him ben,
A strappan youth; he taks the mother's eye:
Blithe Jenny sees the visit's no ill-ta'en;
The father cracks o' horses, pleughs, and kye.
The youngster's artless heart o'erflows wi' joy,
But, blate and laithfu', scarce can weel behave;
The mother, wi' a woman's wiles, can spy
What makes the youth sae bashfu' an' sae grave,
Weel pleas'd to think her bairn's respected like the lave.

O happy love! where love like this is found!
  O heart-felt raptures! bliss beyond compare!
I've paced much this weary mortal round,
  And sage experience bids me this declare:
"If Heav'n a draught of heavenly pleasure spare,
  One cordial in this melancholy vale,
'Tis when a youthful, loving, modest pair,
  In other's arms breathe out the tender tale
Beneath the milk-white thorn that scents the ev'ning gale."

Is there, in human form that bears a heart,
  A wretch, a villain, lost to love and truth,
That can, with studied, sly, ensnaring art,
  Betray sweet Jenny's unsuspecting youth?
Curse on his perjur'd arts! dissembling smooth!
  Are honour, virtue, conscience, all exil'd?
Is there no pity, no relenting ruth,
  Points to the parents fondling o'er their child;
Then paints the ruin'd maid, and their distraction wild?

But now the supper crowns their simple board:
  The halesome parritch, chief o' Scotia's food;
The soupe their only hawkie does afford,
  That 'yont the hallan snugly chows her cood;
The dame brings forth in complimental mood,
  To grace the lad, her weel-hain'd kebbuck fell;
An' aft he's prest, an' aft he ca's it guid,
  The frugal wifie, garrulous, will tell,
How 'twas a towmond auld, sin' 'lint was i' the bell.

The cheerfu' supper done, wi' serious face
  They round the ingle form a circle wide:
The sire turns o'er, wi' patriarchal grace,
  The big ha'-Bible, ance his father's pride:
His bonnet rev'rently is laid aside,
  His lyart haffets wearing thin an' bare:
Those strains that once did sweet in Zion glide,
  He wales a portion with judicious care;
And "Let us worship God!" he says, with solemn air.

They chant their artless notes in simple guise;
  They tune their hearts—by far the noblest aim!
Perhaps Dundee's wild warbling measures rise,
  Or plaintive Martyrs, worthy of the name;
Or noble Elgin beets the heav'nward flame,
  The sweetest air of Scotia's holy lays:
Compar'd wi' these, Italian trills are tame;
  The tickled ears no heart-felt raptures raise;
Nae unison hae they wi' our Creator's praise.

The priest-like father reads the sacred page,
  How Abram was the friend of God on high;
Or Moses bade eternal warfare wage
  With Amalek's ungracious progeny;
Or how the royal bard did groaning lie
  Beneath the stroke of Heaven's avenging ire;
Or Job's pathetic plaint, and wailing cry;
  Or rapt Isaiah's wild, seraphic fire;
Or other holy seers that tune the sacred lyre.

Perhaps the Christian volume is the theme:
  How guiltless blood for guilty man was shed;
How He, who bore in Heaven the second name,
  Had not on earth whereon to lay His head:
How His first followers and servants sped;
  The precepts sage they wrote to many a land:
How he, who lone in Patmos banished,
  Saw in the sun a mighty angel stand,
And heard great Bab'lon's doom pronounc'd by Heaven's command.

Then kneeling down to Heaven's Eternal King,
  The saint, the father, and the husband prays:
Hope "springs exulting on triumphant wing,"
  That thus they all shall meet in future days:
There ever bask in uncreated rays,
  No more to sigh, or shed the bitter tear,
Together hymning their Creator's praise,
  In such society yet still more dear;
While circling time moves round in an eternal sphere.

Compar'd with this, how poor Religion's pride,
  In all the pomp of method, and of art,
When men display to congregations wide
  Devotion's ev'ry grace, except the heart!
The Power, incens'd, the pageant will desert,
  The pompous strain, the sacerdotal stole;
But haply, in some cottage far apart,
  May hear, weel pleas'd, the language of the soul,
And in His Book of Life the inmates poor enrol.

Then homeward all take off their sev'ral way;
The youngling cottagers retire to rest;
The parent pair their secret homage pay,
  And proffer up to Heav'n the warm request,
That He who stills the raven's clam'rous nest,
  And decks the lily fair in flow'ry pride,
Would, in the way His wisdom sees the best,
  For them and for their little ones provide;
But, chiefly, in their hearts with grace divine preside.

From scenes like these old Scotia's grandeur springs,
  That makes her lov'd at home, rever'd abroad:
Princes and lords are but the breath of kings;
  "An honest man's the noblest work of God!"
And, certes, in fair virtue's heav'nly road,
  The cottage leaves the palace far behind.
What is a lordling's pomp?—a cumbrous load,
  Disguising oft the wretch of human kind,
Studied in arts of hell, in wickedness refined!

O Scotia! my dear, my native soil!
  For whom my warmest wish to Heaven is sent,
Long may thy hardy sons of rustic toil
  Be blest with health, and peace, and sweet content!

And, oh, may Heav'n their simple lives prevent
From luxury's contagion, weak and vile!
Then, howe'er crowns and coronets be rent,
A virtuous populace may rise the while,
And stand, a wall of fire, around their much-lov'd Isle.

O Thou! who pour'd the patriotic tide
That stream'd thro' Wallace's undaunted heart;
Who dar'd to nobly stem tyrannic pride,
Or nobly die, the second glorious part
(The patriot's God, peculiarly Thou art,
His friend, inspirer, guardian, and reward),
Oh never, never, Scotia's realm desert,
But still the patriot, and the patriot bard,
In bright succession raise, her ornament and guard!

SHAKESPEARE

Matthew Arnold, in this fine sonnet, conveys a splendid sense of Shakespeare's eminence over all the master-minds that have written in the English language. "Others abide our question" means that while other great poets or thinkers may be open to criticism or to question, Shakespeare speaks through his immortal verse with so divine a voice that we feel it is the very voice of truth itself and cannot be "questioned."

OTHERS abide our question. Thou art free.
We ask and ask—Thou smilest and art still,
Out-topping knowledge. For the loftiest hill,
Who to the stars uncrowns his majesty.

Planting his steadfast footsteps in the sea,
Making the heaven of heavens his dwelling-place,
Spares but the cloudy border of his base
To the foiled searching of mortality;

And thou, who didst the stars and sunbeams know,
Self-schooled, self-scanned, self-honoured, self-secure,
Didst tread on earth unguessed at—Better so!

All pains the immortal spirits must endure,
All weakness which impairs, all griefs which bow,
Find their sole speech in that victorious brow.

TO A BUTTERFLY

The great poet William Wordsworth, in these pretty verses to a butterfly, gives us the proper point of view from which we ought to regard one of the loveliest of all created things. We can hardly read this poem, entering into the loving spirit of the poet, and then go chasing butterflies.

I'VE watch'd you now a full half-hour,
Self-poised upon that yellow flower;
And, little Butterfly! indeed
I know not if you sleep or feed.
How motionless! not frozen seas
More motionless! and then
What joy awaits you, when the breeze
Has found you out among the trees,
And calls you forth again!

This plot of orchard-ground is ours;
My trees they are, my sister's flowers.
Here rest your wings when they are weary,
Here lodge as in a sanctuary!
Come often to us, fear no wrong;
Sit near us on the bough!
We'll talk of sunshine and of song,
And summer days when we were young;
Sweet childish days that were as long
As twenty days are now.

THY WAY, NOT MINE, O LORD

Dr. Horatius Bonar, who was born in Edinburgh, December 19, 1808, and died July 31, 1889, was a celebrated writer of hymns, which breathe the purest faith and hope. We have chosen the following example of his writings, as it is unrivaled for the expression of the Christian's faith, and ranks with Newman's beautiful hymn "Lead, Kindly Light," which is printed on page 2013.

THY way, not mine, O Lord,
However dark it be;
Lead me by Thine own hand,
Choose out the path for me.

Smooth let it be or rough,
It will be still the best;
Winding or straight, it leads
Right onward to Thy rest.

I dare not choose my lot;
I would not if I might:
Choose Thou for me, my God,
So shall I walk aright.

The kingdom that I seek
Is Thine: so let the way
That leads to it be Thine,
Else I must surely stray.

Take Thou my cup, and it
With joy or sorrow fill,
As best to Thee may seem;
Choose Thou my good and ill.

Choose Thou for me my friends,
My sickness or my health;
Choose Thou my cares for me,
My poverty or wealth.

THE CHARACTER OF A HAPPY LIFE

Sir Henry Wotton was a famous Englishman who lived from 1568 to 1639, and was eminent in the service of his country, being for many years its ambassador at Venice. In the later years of his life he became a clergyman, and wrote a number of essays, chiefly of a religious character, Like most of the scholars of his age, he also wrote poetry. He was a great friend of Izaak Walton, and often went fishing on the River Thames with him. Not more than fifteen of his poems are well known, and the following poem is the most familiar.

HOW happy is he born or taught,
That serveth not another's will;
Whose armour is his honest thought,
And simple truth his highest skill!

Whose passions not his masters are;
Whose soul is still prepar'd for death;
Untied unto the world by care
Of public fame, or vulgar breath!

Who envies none that chance doth raise,
Or vice; who never understood
How deepest wounds are given by praise,
Nor rules of state, but rules of good!

Who hath his life from rumours freed;
Whose conscience is his strong retreat;
Whose state can neither flatterers feed,
Nor ruin make oppressors great!

Who God doth late and early pray
More of His grace than gifts to lend,
And entertains the harmless day
With a well-chosen book or friend.

This man is freed from servile bands
Of hope to rise or fear to fall:
Lord of himself, though not of lands,
And having nothing, yet hath all.

THE SPACIOUS FIRMAMENT ON HIGH

On page 548 we gave Joseph Addison's paraphrase of the Twenty-third Psalm, and here we give the same author's paraphrase of the Nineteenth Psalm. In its Bible version this psalm was a great favorite of St. Augustine, and Addison has skilfully retained all the teaching of the original, while expressing it in the modern poetic form.

THE spacious firmament on high,
With all the blue ethereal sky,
And spangled heavens—a shining frame—
Their great Original proclaim.
The unwearied sun, from day to day,
Doth his Creator's power display,
And publishes to every land
The work of an Almighty hand.

Soon as the evening shades prevail,
The moon takes up the wondrous tale,
And, nightly, to the listening earth,
Repeats the story of her birth:
Whilst all the stars that round her burn,
And all the planets in their turn
Confirm the tidings as they roll,
And spread the truth from Pole to Pole.

What though in solemn silence all
Move round this dark terrestrial ball;
What though no real voice nor sound
Amidst their radiant orbs be found.
In reason's ear they all rejoice,
And utter forth a glorious voice,
For ever singing as they shine:
The hand that made us is Divine.

LULLABY! O LULLABY!

The writer of the following very popular baby song was William Cox Bennett, originally a watchmaker at Greenwich, where he was born in 1820. He afterwards became a journalist and wrote many songs and sketches, dying in 1895.

LULLABY! O lullaby!
Baby, hush that little cry!
Light is dying,
Bats are flying,
Bees to-day with work have done;
So, till comes the morrow's sun,
Let sleep kiss those bright eyes dry!
Lullaby! O lullaby!

Lullaby! O lullaby!
Hush'd are all things far and nigh;
Flowers are closing.
Birds reposing,
All sweet things with life are done.
Sweet, till dawns the morning sun,
Sleep then kiss those blue eyes dry
Lullaby! O lullaby!

AMBITIOUS SOPHY

We have already printed two little poems by Mrs. Elizabeth Turner, whose simple verses pleased our grandmothers when they were young. She is the author of this poem.

MISS SOPHY, one fine sunny day,
Left her work and ran away;
When soon she reach'd the garden gate,
Which finding lock'd, she would not wait,
But tried to climb and scramble o'er
A gate as high as any door.

But little girls should never climb,
And Sophy won't another time;
For when, upon the highest rail,
Her frock was caught upon a nail,
She lost her hold, and, sad to tell,
Was hurt and bruised—for down she fell.

THE BABY AND THE BROOK

In this very beautiful song, sweet with the fresh charm of Nature, Longfellow, the American poet, has given an English setting to a short poem by the famous Armenian writer named Leon Alishan, which has been popular among the countrymen of that poet for many years.

DOWN from yon distant mountain height
The brooklet flows through the village street;
A boy comes forth to wash his hands,
Washing, yes, washing; there he stands,
In the water cool and sweet.

Brook, from what mountain dost thou come?
O my brooklet cool and sweet
I come from yon mountain high and cold.
Where lieth the new snow on the old,
And melts in the summer heat.

Brook, to what river dost thou go?
O my brooklet, cool and sweet!
I go to the river there below
Where in bunches the violets grow,
And sun and shadow meet.

Brook, to what garden dost thou go?
O my brooklet, cool and sweet!
I go to the garden in the vale
Where all night long the nightingale
Her love-song doth repeat.

Brook, to what fountain dost thou go?
O my brooklet cool and sweet!
I go to the fountain at whose brink
The maid that loves thee comes to drink,
And whenever she looks therein,
I rise to meet her, and kiss her chin,
And my joy is then complete.

BE PATIENT WITH THE CHILDREN

This little poem is anonymous, but the writer was evidently one who had a wonderful understanding of "Christ's little ones."

THEY are such tiny feet,
They have gone such a little way to meet
The years which are required to break
Their steps to evenness, and make
Them go
More sure and slow.

They are such little hands.
Be kind—things are so new, and life but stands
A step beyond the doorway. All around
New day has found
Such tempting things to shine upon; and so
The hands are tempted oft, you know.

They are such fond, clear eyes,
That widen to surprise
At every turn. They are so often held
To sun or showers—showers soon dispelled
By looking in our face.
Love asks, for such, much grace.

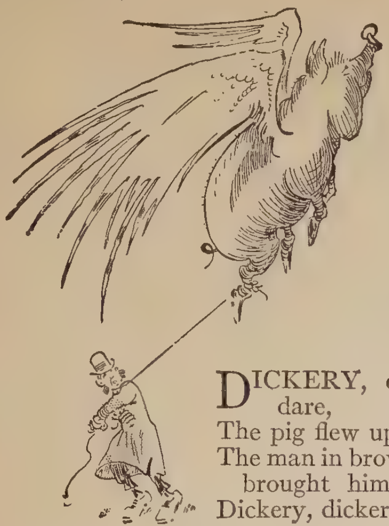
They are such frail, frail gifts,
Uncertain as the rifts
Of light that lie along the sky—
They may not be here by-and-by.
Give them not love, but more, above
And harder—patience with the love.

ASPIRATION.

I know this earth is not my sphere,
For I cannot so narrow me but that
I still exceed it.

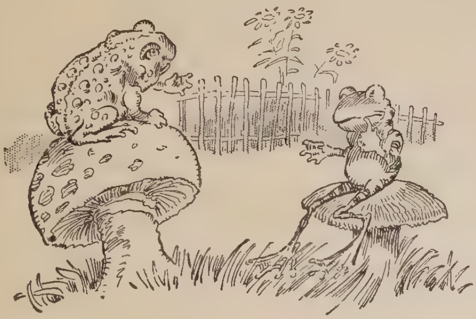
LITTLE VERSES FOR VERY LITTLE PEOPLE

BOW, wow, wow, whose dog art thou?
Little Tom Tinker's dog.
Bow, wow, wow.



DICKERY, dickery, dare,
The pig flew up in the air;
The man in brown soon brought him down,
Dickery, dickery, dare.

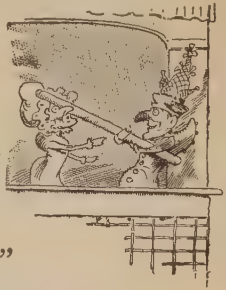
"CROAK," said the toad, "I'm hungry, I think,
To-day I've had nothing to eat or to drink;
I'll crawl to a garden and jump through the pales,
And there I'll dine nicely on slugs and on snails."



"Ho, ho!" quoth the frog, "is that what you mean?
Then I'll hop away to the next meadow stream,
There I will drink, and eat worms and slugs, too,
And then I shall have a good dinner, like you."

PETER, Peter, pumpkin eater,
Had a wife and couldn't keep her;
He put her in a pumpkin shell,
And there he kept her very well.

MOLLY, my sister, and I fell out,
And what do you think it was about?
She loved coffee, and I loved tea,
And that was the reason we couldn't agree.

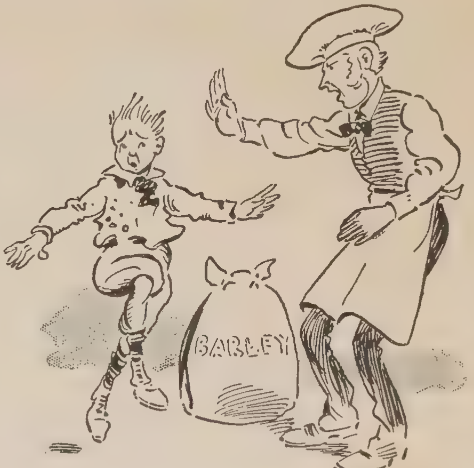


PUNCH and Judy
Fought for a pie,
Punch gave Judy
A knock in the eye.
Says Punch to Judy:
"Will you have any more?"
Says Judy to Punch:
"My eye is too sore."

HUSH-A-BYE, baby,
Daddy is near;
Mamma is a lady,
And that's very clear.

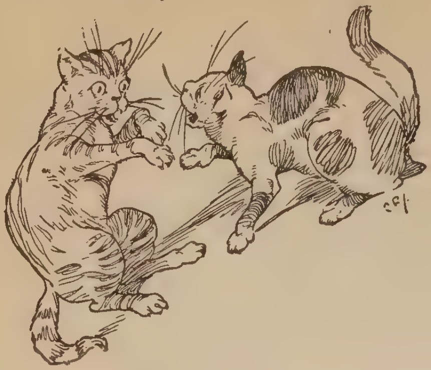
THERE were three sisters in a hall;
There came a knight amongst them all.
Good-morrow, aunt, to the one;
Good-morrow, aunt, to the other;
Good-morrow, gentlewoman, to the third.
If you were my aunt,
As the other two be,
I would say good-morrow,
Then, aunts, all three.

CHARLEY, Charley, stole the barley
Out of the baker's shop,



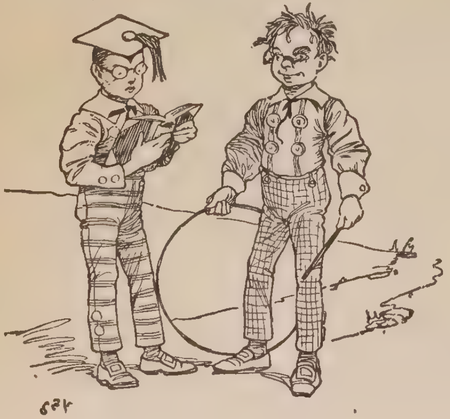
The baker came out and gave him a clout,
Which made poor Charley hop.

THERE were once two cats of Kilkenny,
Each thought there was one cat too many;



So they fought and they fit,
And they scratched and they bit,
Till, excepting their nails
And the tips of their tails,
Instead of two cats, there weren't any

CLAP, clap handies,
Mammie's wee, wee ain;
Clap, clap handies,
Daddie's comin' hame;
Hame till his bonny wee bit laddie;
Clap, clap handies,
My wee, wee ain.

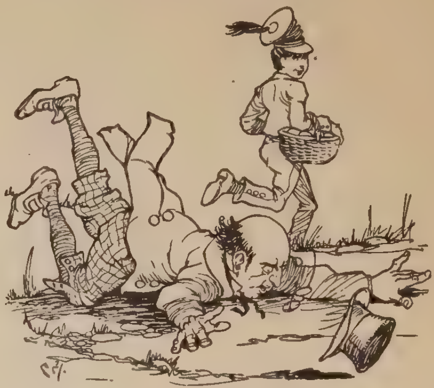


LITTLE Bobby Snooks was fond of his books,
And loved by his usher and master;
But naughty Jack Spry, he got a black eye,
And carries his nose in a plaster.

PUSSY-CAT Mew jumped over a coal,
And in her best petticoat burnt a great hole.
Poor Pussy's weeping, she'll have no more milk,
Until her best petticoat's mended with silk!

LAVENDER blue and rosemary green,
When I am king you shall be queen;
Call up my maids at four o'clock,
Some to the wheel and some to the rock,
Some to make hay and some to shear corn,
And you and I will keep ourselves warm.

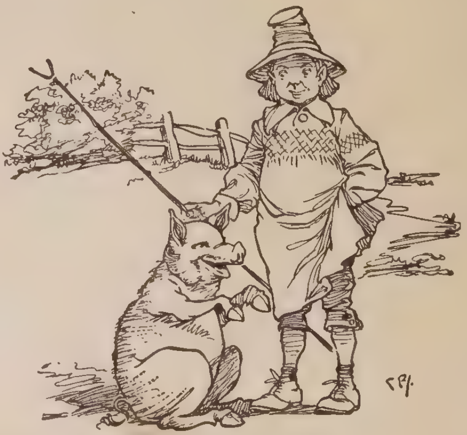
A NICK and a nock,
A hen and a cock,
And a penny for my master.



AS I was going to sell my eggs,
I met a man with crooked legs;
Crooked legs and turned-up toes,
I tripped up his heels, and he fell on his nose.

ROBIN-A-ROBIN
Bent his bow,
Shot at a pigeon,
And killed a crow.

JACK SPRAT had a pig, who was not very little, nor yet very big;
He was not very lean, he was not very fat;
He'll do well for a grunt, says little Jack Sprat.



The Invalid is Interested and Amused.

THE WONDER OF RADIO

CONTINUED FROM 4061

WE live in an age of marvels. One wonderful invention follows another, and no one can even guess the limits of the inventive power of man. We take all these inventions as a matter of course and seldom stop to think how different is the world in which we live from the world in which our grandfathers or our great-grandfathers grew up.

We have told you of many of these wonderful inventions. The changes and improvements in methods of communication have been among the greatest of all. We have told you of the locomotive, the steamboat, and the airplane; of the phonograph, the telegraph, and the telephone. Now we come to radio, the latest of the wonders. If you will read the stories of the telegraph and the telephone first you will understand radio better.

To make slender wires carry signals or speech seemed a miracle. When it was found that these same signals could be carried without wires, as told in Volume XI, the whole world gasped. Scientists were sure that some day speech and other sounds would also be carried, but the spark-gap, about which you will read in the story of the telegraph, did not carry speech very well. Much study and many experiments were necessary before delicate instruments were constructed which would carry clearly and surely the sounds uttered many miles away, and give them back without change. Great progress was made during the World War, but it was not until about 1920 that the radio-telephone became a popular success.

Now its use is almost world-wide. One of our readers may be in a lonely farmhouse among the hills, another in a city apartment, and a third, perhaps, in a lighthouse on an island. The only sounds they hear are the wind in the tree-tops, the dull roar of traffic, or the beat of the waves. With the turn of a knob each may hear the same things. Perhaps the voice of a famous singer is being heard by thousands instead of hundreds; perhaps a great orchestra is playing some masterpiece; perhaps a teller of stories is amusing the little folks; perhaps the scores of baseball games are being given inning by inning, sometimes play by play; perhaps the weather man is telling of an approaching storm, or market reports are being sent out to the farmers. In fact these broadcasting stations have something for every member of the family. We shall tell you more of them in a moment.

RADIO WAVES AND SOUND WAVES IN THE ATMOSPHERE

Now let us see how it is done. What

Copyright, 1922, by M. Perry Mills.

does radio mean? You are told elsewhere in our book that sound waves travel through the air at the rate of a mile in about five seconds, though they travel faster through metal. It has been found that electro-magnetic waves can be set up in the atmosphere. They travel at the speed of light; that is, 186,000 miles a second, several hundred thousand times as rapidly as sound waves. The waves pass not only through the atmosphere but also through walls, forests and mountains. Some are absorbed, but enough get through to affect the sensitive receiver, but they cannot be felt by any of our five senses. That is, our unaided senses cannot tell whether the air is empty or full of these waves. The waves travel in all directions from the center from which they begin. Have you ever thrown a pebble into a pond and watched the circles of waves move out to the banks, growing weaker as the distance increases? Radio waves in the atmosphere move in a similar way, except that they move outward in every direction. Perhaps you can understand the way they spread better if you think of a soap-bubble growing larger and larger. Now think of a succession of smaller bubbles, each inside the next larger one and each growing larger and larger; or think of the way the rays of light from a candle spread in every direction. Remember these illustrations, for you will need them again.

WHAT DO WE MEAN BY WAVE LENGTH?

These radio waves are produced by the vibration or oscillation of electric current. There is more than one kind of electric current. A direct current flows steadily in one direction, but direct current does not produce radio waves. An alternating current flows in one direction until it reaches its height, flows back, rises again, flows back, and so on with marvelous rapidity. Each complete change is called a cycle. Ordinary lighting current in an electric lamp goes through about sixty cycles in a second. The rate of radio vibration is much higher—from 20,000 to as much as 6,000,000 cycles every second. This is called radio frequency.

You have been told that radio waves travel 186,000 miles in a second. Then it is plain that the length of a wave, by which we mean the distance from the top of one to the top of the next, will be the distance that the current travels in a second divided by the number of vibrations in the same time. Now 186,000 miles is about 300,000,000 metres. This sum divided by 1,000,000, say, gives a wave length of 300 metres. By regulating the number of cycles, different wave lengths may be obtained. In order to hear clearly, the receiving end must be tuned to the same wave length sent out by the transmitter.

THE FOUR REQUIREMENTS OF RADIO

Now, how are these waves set in motion, and how are they received? These four things are required: (a) a transmitter which will change the sound waves produced by the voice or musical instrument into electro-magnetic or radio waves; (b) an antenna or aerial which will set them loose in the atmosphere; (c) a receiving antenna which will respond to the waves sent out by another antenna perhaps hundreds of miles away; (d) a receiver which will transform these radio waves back into sound waves.

It would take a whole book to describe the different kinds of instruments which may be used for sending and receiving. In fact there are dozens of books which tell how to set up and use radio sets, and the boy or girl who wishes to set up a set, or even to make one, would do well to get one of these books. Our space will not allow us to go into all the details.

There are many kinds of transmitters, but the principle is the same in all. There must be a source of electric current. This current must be changed into a high or radio frequency current. A mouthpiece which responds to sound waves must be connected with the current, so that the sound waves may be transformed into radio waves. A wire must lead to the antenna which flings the waves into the atmosphere. This antenna is a wire or wires stretched between two points some distance above the ground. The more expensive sets can be adjusted to give radio waves of several lengths. The cheaper sets cannot.

WHAT THE SIMPLEST RECEIVING SET REQUIRES

Most of our readers are more interested in receiving than in sending, and the difference between receiving sets is greater than in the sending sets. The very simplest receiving set has an antenna with a wire leading down to the receiving room, another wire to the ground, a detector

SPEECH AND MUSIC ARE SEEN AND HEARD

Dean Fay of Tufts College is here shown reading the first of a series of lectures into a sensitive microphone. This lecture was heard by thousands, some of them many miles away.

Miss Jean Wood of Toronto, Canada, is playing a piano selection. Though the audience is not visible it is much larger than could be packed into any hall, however large.

Mario Chamlee, Orville Harrold, tenors, and Madame Lucrezia Bori, soprano, all of the Metropolitan Opera Company, are having tea in Madame Bori's apartment, in New York City. Incidentally they are listening to a concert given, perhaps, by some of their colleagues, which is coming through the air from the broadcasting station at Newark, N. J., miles away. Pictures from Underwood & Underwood, N.Y.; 2nd and 3d copyright.

which transforms the high frequency radio waves into currents which travel in one direction only, and a telephone receiver which makes waves audible. The simplest detector is a mineral crystal, which, by allowing the waves to pass through in one direction much better than in another, changes (rectifies) the alternating current into a direct current. The most popular crystal is galena (lead sulphide).

Such a set requires no battery and costs very little, but it is not very satisfactory. Generally it will catch messages from stations near by, but it cannot be tuned to receive only waves of a given length. Therefore, if two or more stations are transmitting, there is likely to be confusion, just as there is when you try to listen to two people talking at the same time. A tuning coil or a variometer may be added, and then one can select the length of wave one wishes to hear.

It is possible to make these sets very small. One man has made a set which is fastened to a ring which he wears on his finger. There are pocket sets in which the tiny detector is fastened on the back of a small telephone receiver. Two tiny spools of wire are attached. One wire can be attached to a large umbrella or to a fire escape, or even to an iron bed, which is made to serve as a receiving antenna, and the wire from the other spool is attached to a water pipe or an iron fence which serves as a ground. With such a set one can pick up waves sent by a powerful station near by.

In fact in a receiving set an antenna set high in the air is not absolutely necessary. Since the radio waves pass through walls and fill the atmosphere everywhere, a loop antenna set up inside the house is sometimes used. This loop is a wooden frame around which is wound a number of turns of wire, spaced about an inch apart. One man, whose landlord would not allow him to set up an antenna on the roof, dropped a wire down the chimney. The radio waves passed through the bricks, and he was able to hear sending stations near by. Another man ran a wire around the room behind the picture molding. There are receiving sets no longer than a policeman's club which can be carried anywhere. Of course none of these sets is so sensitive as one with a high antenna. In cities, however, the loop antenna is being used very frequently.

THE LITTLE INVENTION WHICH MAKES THE WIRELESS TELEPHONE POSSIBLE

The better sets use a vacuum tube instead of a crystal detector. In fact this little vacuum tube is what makes radio, as we have it to-day, possible. The vacuum tube is a glass tube, much like an electric lamp. Within is a tungsten filament (around which is a coil of wire called a grid), and a plate. The vacuum tube has three important uses. In the transmitter it will convert direct current from a storage battery into the high frequency alternating current which will produce the radio waves and does away with the spark-gap; in the receiver it will take the place of a crystal detector and change radio waves into direct currents, and it can also be used to make the sounds stronger. By using enough vacuum tubes one can increase or amplify the sound of a voice so that it can be heard for miles. With vacuum tube sets electric batteries are necessary.

THE MEN WHO INVENTED RADIO

No one man can be said to be the inventor of the radio-telephone. The principles are the same as those of the radio-telegraph, though of course it is harder to transmit speech or music than signals. Only a few of the experimenters can be mentioned. Professor R. A. Fessenden made an experimental radio-telephone as early as 1900. Improvements were made by E. W. F. Alexanderson, and again by Valdemar Poulsen. Dr. Lee de Forest, who had already done much for radio-telegraphy, discovered some of the properties of the vacuum tube. The work of Dr. Irving Langmuir and Major E. H. Armstrong is important. There are dozens of others, perhaps equally important.

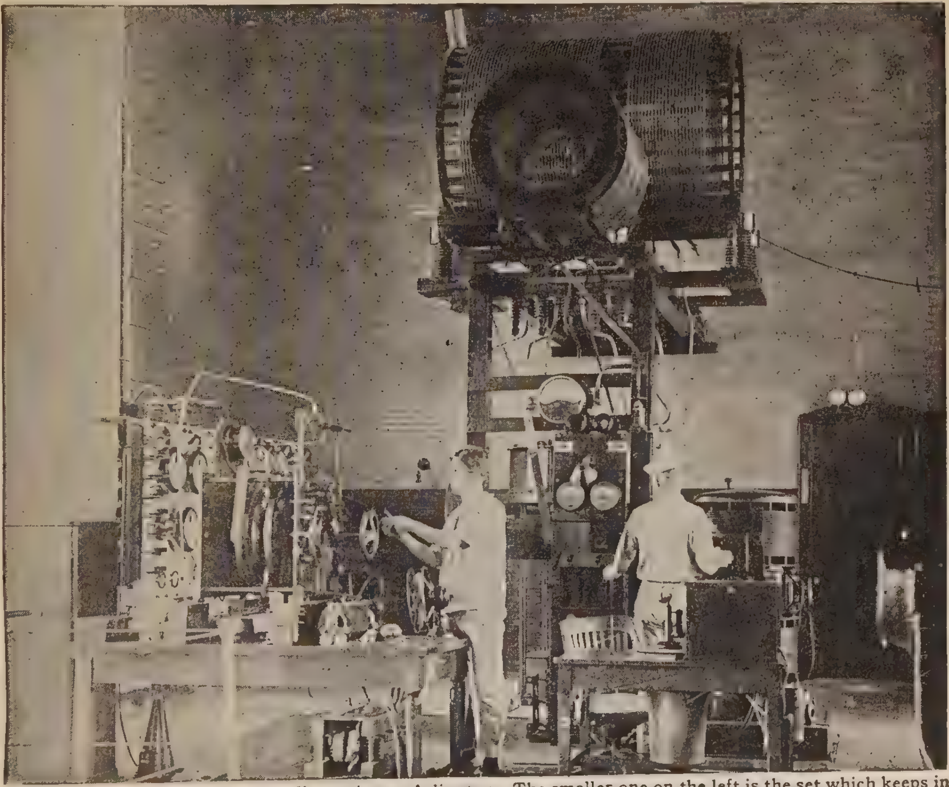
WHAT ARE BROADCASTING STATIONS?

The great companies which make electrical apparatus worked long and hard to improve and simplify the instruments for radio-telephony. When they succeeded they set up great stations with powerful transmitters in different parts of the country. Each station always uses the same wave length, which is different from that used by other stations, and flings the waves into the air in every direction. Daily programmes are made up and advertised. At every hour of the day there is something of interest for some member of the family; or, if one has a good re-

SOME INTERESTING USES OF RADIO

General Pershing is here shown listening to a message out of the air and is making a memorandum. The use of radio in any future military and naval operations will be exceedingly important and helpful.

Here is a portable field set which can be carried anywhere. Notice the antenna fastened to the tree, and the wires coming down to the instruments on the ground. Picture from Brown Bros.



These two sets are in the naval radio station at Arlington. The smaller one on the left is the set which keeps in constant communication with President Harding when he is on the Mayflower, the boat assigned to the President's use. The larger set is used for scout purposes and has a longer range. Notice that it uses loop antennae, turned in different directions. 1st and 3d pictures copyright by Underwood & Underwood, N.Y.

ceiving set, one can select from two or even three programmes given many miles apart. A family in a little village in the woods can keep in touch with the world.

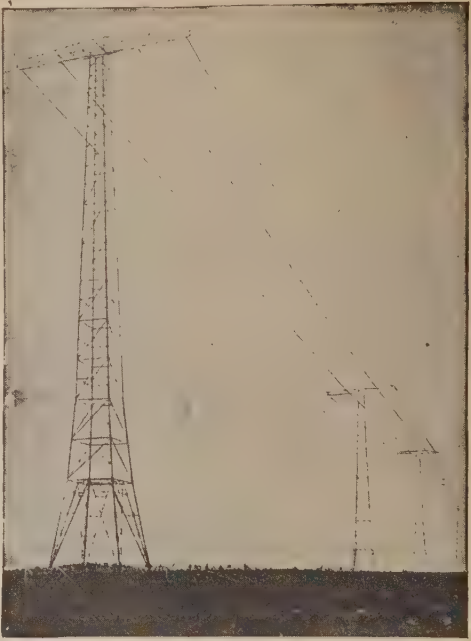
These broadcasting stations are maintained by the manufacturers at great expense, in order to increase the demand for instruments. Any one can listen in who can tune his receiver to the proper wave length. How long the manufacturers will find it profitable to pay singers, orchestras, lecturers and story-tellers, no one can say. Some one will continue to maintain them, however. Perhaps a small fee will be charged every purchaser of instruments; perhaps the government will collect a tax from every owner for the purpose of keeping up the stations; perhaps the government will keep them up just as it maintains schools. The plan is too valuable to be given up.

It is perfectly possible to arrange any auditorium, concert hall, or opera house, so that the lecture or the music can be sent out into the air to be gathered by listeners for hundreds of miles around, but there is no way of collecting pay for the service. The management objects to sending free, because many people would listen at home instead of paying admission to the performance.

WILL RADIO TAKE THE PLACE OF WIRES ALTOGETHER!

It is not likely that radio will soon take the place of wires entirely, for several reasons. In a great city there are many thousand telephone subscribers. It would be impossible to assign a different wave length to each individual, and when two stations are sending out the same wave length there is confusion. In addition, there is as yet no such thing as privacy in radio. Any message sent out can be caught by any receiver which can be tuned to the proper wave length, and so the most private conversation can be heard by all. It seems that for short distances we shall continue to telephone by means of wires.

On the other hand radio will be a great addition to wire systems. It is perfectly possible for a subscriber to call up his central by wire, ask to be connected with the radio station, which will call some one on a ship far out at sea to the radio room on the ship, and the two can then talk with ease. In fact something like this is done regularly. Santa Catalina Island is a popular summer resort over thirty miles from the California mainland. There is a radio station at Pebbly Beach on the island, and another on the mainland at Long Beach, twenty-five miles from Los Angeles. Any subscriber in Los Angeles can talk with any subscriber on the island. The message goes in this way: from the subscriber to central (by wire); to Long Beach (by wire); to Pebbly Beach (by radio); to an island central (by wire); to the individual subscriber (by wire). In fact subscribers in San Francisco often talk to friends on the island by way of Los Angeles, thus adding two more links to the chain.



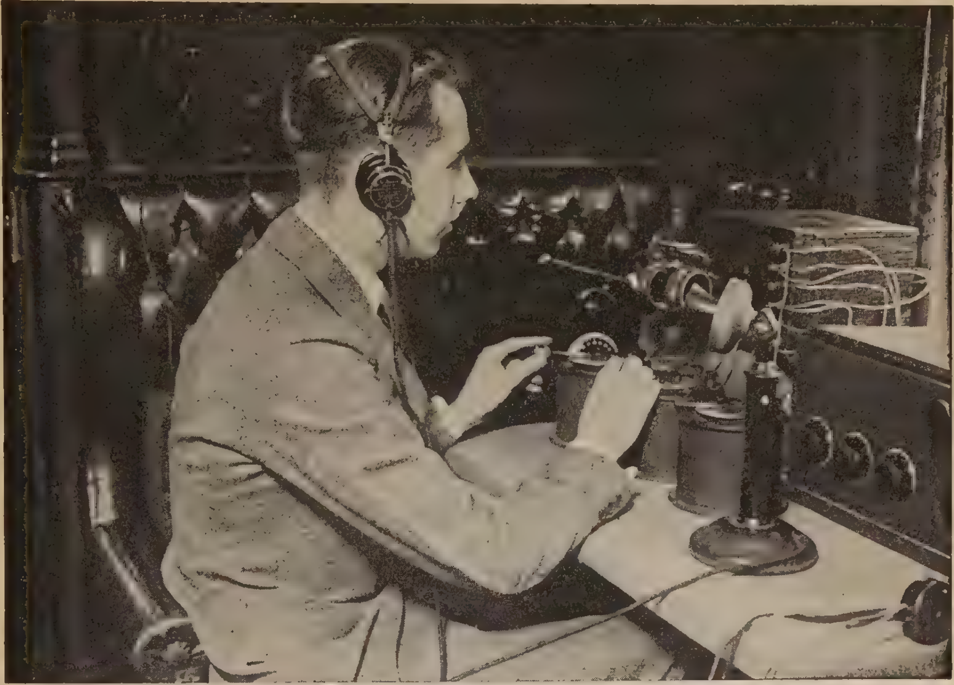
This is a small part of the aerial wires at the new radio station at Port Jefferson. Each of the steel towers is more than four hundred feet high. This station will communicate with Europe, South America and the Pacific Islands.

Picture from Underwood and Underwood, N. Y.

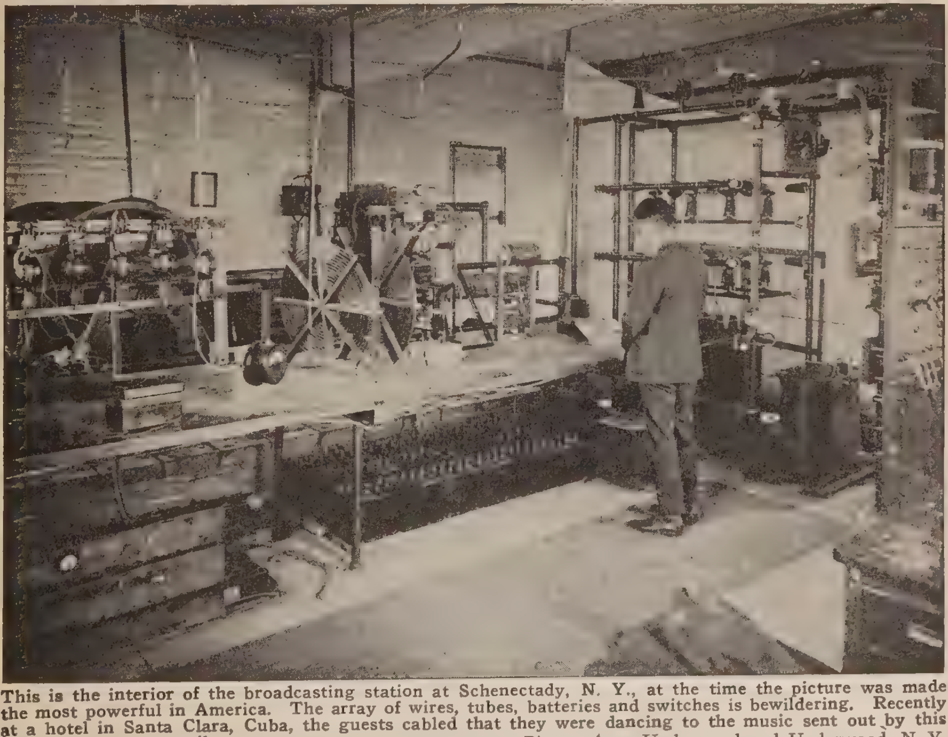
For long-distance work radio will become very important. It is expensive to set up and maintain a thousand miles of wire on poles. Powerful radio stations will cost much less, and will serve the purpose quite as well, if not better, for wires are constantly breaking on long lines. Explorers in the future will carry radio sets, and many lives will be saved as a result. It is probable that men will soon talk regularly across the ocean. Already the United States Government station at Arlington has talked with Honolulu, Hawaii, and it is likely that such communication will become common.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4127.

A TRAIN SET AND A BROADCASTING STATION



Elsewhere we have shown the process of telegraphing by radio from a moving train. The Delaware and Lackawanna Railroad has now equipped some of its trains with radio-telephone sets, so that messages can be sent and received from the train while in motion. Undoubtedly the ability to communicate with a train which has passed a signal will prevent many accidents. Copyright Underwood and Underwood, N. Y.



This is the interior of the broadcasting station at Schenectady, N. Y., at the time the picture was made the most powerful in America. The array of wires, tubes, batteries and switches is bewildering. Recently at a hotel in Santa Clara, Cuba, the guests cabled that they were dancing to the music sent out by this station nearly 1,500 miles away. Picture from Underwood and Underwood, N. Y.

BOYS SHOW THEIR INTEREST IN RADIO

This youngster of five years is interested and has learned to tune the set so that the sounds are clear. Notice the amplifier or loud-speaker which can be used with this set.

A schoolboy of Plainfield, N. J., only twelve years old, has made a receiver which will fit into an ordinary safety match box. He and his brother, both Boy Scouts, are listening to a concert.

This fortunate youth can always amuse and interest any of his friends who come to visit him. By using the headbands instead of the loud-speaker they do not disturb other members of the household. Some of the best work in radio is being done by youthful amateurs, and the results will doubtless show in many improvements as they grow older. Upper pictures copyright by Underwood & Underwood, N.Y.; lower from Brown Bros.

THE STORY OF THE BRITISH EMPIRE

WE have finished the history of England, yet the story is as wide as the world. The English live on a little island which seems hardly more than a speck on the map, yet from that little kingdom has grown an empire greater than any other empire that has been. One-fifth of the whole earth and one-fifth of its peoples live under the British flag. If we could walk over the earth, one out of every five persons we met would belong to the British Empire. So vast is this Empire that the sun never sets upon it; it is an empire of eternal sun. We have read the story of all parts of the empire, but here, in these pages, we get an idea of what the British Empire itself means and how it has come to be. Great Britain has become a great nation because her sons have carried freedom beyond the seas, and it is a fine and solemn thing for them to remember that they are helping to make a nation whose influence reaches to every corner of the earth.

THE EMPIRE OF ETERNAL SUN

CONTINUED FROM 3933

THREE hundred years ago England and Scotland and Ireland were all ruled by a single king; they had been united for the first time under one monarch, James VI. of Scotland, who became James I. of England. But even then the nation did not include, outside of the British Isles, a single scrap of all the lands marked red on the map of the world to-day.

Yet that was 1,100 years after the Saxon Cerdic set up the kingdom of Wessex, and began the line of kings whose blood runs now in the veins of George V. In these three hundred years—quite a small space of time in the history of the British race—the whole of this great empire has been built up; and another great portion of the earth's surface—the history of which belongs to the same three hundred years—is also in possession of the same race, though it is not part of the empire, as it once was, and as it still might have been, perhaps, but for the blunders of statesmen one hundred and fifty years ago.

How was it that this great expansion, or spreading out, of the peoples of these small islands took place, so that regions so vast have fallen under their dominion in so short a time; that they have taken upon themselves the task of ruling millions upon millions of peoples with black skins and yellow skins, and of making the earth yield up her riches in lands where earlier inhabitants had been content to roam from place to place, plucking the fruits which grew ready to hand, or slaying wild creatures with bow and arrows?

Well, there had been no chance of expansion till just about a thousand years after Cerdic came to England. It was only then that Christopher Columbus found out that if ships sailed on and on westwards from Europe across the Atlantic they would come at last to land, which in those days men called the New World. And it was only then that the Portuguese sailors found out that if they sailed on and on southwards they could get round the end of Africa, and so sail on to the north-east till they came to India.

As Columbus was in the service of the King and Queen of Spain when he discovered America, the Spaniards claimed that it was a possession of theirs; while the Portuguese mariners made themselves lords of the Indian Ocean; and so those two nations got much store of merchandise and spices from the East, and of gold and silver from the mines in South America.

Now, at first the other European nations tried only to find whether other parts of America, to which the Spaniards had not gone, might not be richer than the islands of the West Indies or than the "Spanish Main" itself, for this was the name by which the lands of which the Spaniards had taken possession were called. But presently the English began to think there was no reason why the Spaniards should be allowed to shut everyone else out of those lands, where it seemed almost as if there was nothing to do but pick up gold and silver, or make the natives do it for you; and so they began to fight the Spaniards.

HOW WALTER RALEIGH BEGAN BUILDING UP THE BRITISH EMPIRE

Then there arose, also, men with greater visions than those of just gathering up wealth at ease—men who dreamed of planting colonies, of creating a new England beyond the seas where wealth might be won, not without effort, but by energy and skill and endurance.

The first attempts which Sir Walter Raleigh made in the reign of Queen Elizabeth came to naught—because men were not content with the slow way of industry when the capture of a Spanish galleon might make a man rich for life at one blow. But in the reign of James I. the plans of Raleigh were at last carried out, when sundry merchants and others banded together to settle a number of Englishmen in a colony which they called Virginia.

Now, the peoples of North America, whom the English called Indians—because at first it had been supposed that it was India itself that Columbus had reached—lived for the most part in tribes, which roved from place to place; and they were fierce and merciless in their manner of warfare. And often grounds of quarrel would appear between the Englishmen and the redskins; so that many a time the settlers had to fight for their lives, and many times they gave the Indians reason to hate them, and to fear them, too.

THE MEETING OF ENGLISHMEN, FRENCHMEN, AND DUTCHMEN IN AMERICA

Nevertheless, the settlers prospered, and others came after them; and presently further northward there came new bands of colonists—Puritans, who were ready to leave their own homes in England in order that they might practise their religion after their own fashion, and not as they were ordered by the King of England. And then there came Dutchmen, who took possession between Virginia on the south and these "New England" colonies on the north. But soon afterwards, when there was a war between England and Holland, the Dutch gave up those colonies to England, and the English gave the name of New York to the principal town which had been Dutch. There came Frenchmen, too, who made colonies still further north, in what we call Canada, and further south in Louisiana.

Meanwhile, other merchants had banded themselves together to trade in the East with India and the islands which were called the Spice Islands; one company in London, and another in Holland. For the most part, it was the Dutch who sought trade in the Spice Islands, and the English who sought it in India. The English got leave from the Emperor of India, who was called the Mogul, to set up what was called a "factory," which meant offices and warehouses to store the goods which they bought from the Indians and the goods which they brought from England to sell. Later on when Charles II. married a Portuguese wife the Portuguese gave him Bombay, which had come into their possession long before.

HOW NORTH AMERICA WAS DIVIDED INTO BRITISH COLONIES

In this way the English got trading stations, or factories, at Bombay, and Madras, and Calcutta; and the French got trading stations not far from Madras and Calcutta.

So, a hundred and fifty years ago, the way of things was this. The English had for a long time given up troubling themselves about South America, which they left to the Spanish and Portuguese, as well as Mexico, the south-west corner of North America. But in North America, all along the coast from Florida in the south to Nova Scotia in the north, the country was divided up into British colonies or states, which had to obey any laws that were made for them by the Parliament of Great Britain, but were allowed in other ways to govern themselves. On the north and on the south were French colonies, but in the west the Indians still owned the land. The French and the British both thought they had a right to all that land, taking no count of the rights of the Indians; and since they would not share it, but each nation meant to have it, a time came when the two countries went to war. At the end of the war the British had beaten the French so badly that France gave up Canada to England altogether, and all the French colonists in Canada became the subjects of King George III., and they or their descendants have been subjects of the British Crown ever since.

THE QUARREL IN WHICH AMERICA BROKE AWAY FROM THE MOTHERLAND

After that time numbers of Englishmen and Scots and Irishmen went out to Canada as colonists, as well as many people from the other American colonies. And so to this day many of the people of Canada are British and many of them are French; but all are loyal members of the British Empire. It so came to pass that, not long after Canada became British, the other colonies in America had such a quarrel with the Mother Country that there was a great war; and at the end of it, owing to the defeat of the British army, those colonies were separated altogether from the empire, and became the United States of America.

Now, while the French and the British were fighting out the question which of the two was to possess North America, they were also fighting out the question which of the two was to possess India—though neither of them at the time really guessed that India itself was going to be conquered.

For India was not at all like North America, where there were no civilized states, but only wild tribes. For India was made up of a number of great states containing many rich and great cities, and having vast armies with cannon like the Europeans, and strong fortresses. The rulers of those states owned the Mogul as emperor, though they paid little enough heed to his will.

FRENCH AND BRITISH GO TO INDIA ON BUSINESS, AND BEGIN FIGHTING

But as for the British and the French, they just had their few "factories" on the coast, with a little bit of ground, and a very few soldiers and guns in case they had to defend themselves from attack; and the rest of their people were the clerks and traders and managers, who were called governors, in the service of the British and French companies.

They had no wish to conquer the native states, and hardly anyone thought that it would be at all possible even if they did wish it. Only the French and British were each of them anxious to get all the best of the trading into their own hands, and to persuade the native rulers to give them advantages over the rival nation.

So when war broke out between England and France, the British and French in the south of India began to fight each other; and then, when some native princes began to fight each other for the thrones of their states, the French and British joined in on opposite sides. The end of it was that the British side won, and the French had to promise to keep no more soldiers in India at all.

But more than that: during the fighting the British themselves and the native princes learned that a few British soldiers, or native soldiers led by British officers, could defeat huge native armies. And when the prince who was called the Nawab of Bengal attacked the British in their factory at Calcutta, he was completely overthrown; and though a new Nawab was set up in his place, the Mogul very soon afterwards agreed that the British should govern Bengal; and that they could rule the country round Madras almost as if it belonged to them.

THE WAY IN WHICH THE BRITISH BEGAN TO RULE IN INDIA

Then, when the native princes saw that a new power had appeared in India, whenever they had quarrels among themselves one or another would ask the British to help them, or to protect them; while some of them thought that if they could only destroy the British they would be able to make themselves lords of their neighbours' lands. And whenever the British had to go to war, either to defend themselves or to protect an ally, the end of it was that some more lands came under the British rule.

So it happened that by degrees half of India passed into the hands of the British, while the various princes of the other half governed their own territories, but had to obey when the British thought fit to interfere. And at last, after the Moguls had disappeared altogether, the Queen of Great Britain and Ireland was proclaimed Empress of India, and all the princes owned her as their supreme ruler.

Now, here is a wonderful thing to think of: that although there are in India ten times as many natives as there are people in the British Islands, and a thousand times as many as the British in India itself, yet they are ruled over by the British people. The British nation has taken upon itself the task of giving justice and order and good government to all those millions of people, whose ways are so utterly unlike their own that the wisest men who go to India, and spend their lives trying to do what is best for the people under their charge, come back at the last saying that they still know hardly anything about them. All that can be done is to strive to do justice among them; for this at least we know, that their lot will be better, and their lives and property safer while British rule is unshaken, than ever it was in the past, or would be if their rule were ended.

HOW THE BRITISH FLAG CAME TO WAVE OVER THE DUTCH IN AFRICA

But, besides India and Canada, our map shows us that the empire includes a larger part of Africa and all Australia, as well as New Zealand and a great number of smaller islands both in the Pacific Ocean and in the West Indies—that is, the islands near the central part of America, in the Atlantic.

Now, in South Africa, the Dutch were before the British; but when the French Emperor Napoleon made Holland really subject to France, then the English, being at war with him, made the Dutch in South Africa submit to them. After the war was over, and Holland was freed from the French dominion, the King of Holland agreed that England should keep South Africa. Still, the Dutch there did not like English rule, and some of them founded two states farther inland.

Even quite a short time ago England had a war with those states, the end of which was that they, too, were brought under the British flag; for before that war the English said that they were really subject to the Crown, though it had been agreed they should govern themselves, while they said that they were not subject to the Crown at all. But now everyone, British and Dutch alike, has just the same rights of sharing in the government, and all are free citizens of the empire, just as in Canada there is no difference between the people of French and of British descent.

THE MANY KINDS OF PEOPLE WHO LIVE UNDER THE BRITISH FLAG

In Africa, however, there are a great many more natives—who are either negroes, with black skins, or Hottentots, with brown skins—than there are white people. And these natives have to obey the laws which the white people make, though they are allowed to keep up their own customs unless they are dangerous or do harm in other ways.

Those native tribes which are warlike, and came centuries ago from other parts of Africa to conquer the quiet tribes, have to be watched very carefully. This makes the business of government all the more difficult, because people in England are always very anxious not to be harsh or unjust to the natives, and white people in Africa know that they must never let the natives imagine for a moment that they could conquer the whites. Opinions differ, and the people in England and the people out there do not always agree about what is best to be done.

The way in which the British Empire spread in Australia and New Zealand was not the same as in America, or India, or even Africa, for they have never had to fight about these lands.

A hundred years ago there were few Europeans in New Zealand, and fifty years before that there were not many more in Australia. The natives of New Zealand are a very vigorous people, called Maoris; the colony was started by making a treaty with the Maoris, who agreed to obey English rule. Still, it was a long time before they and the British settlers became friendly; that was brought about mainly because a great English governor, named Sir George Grey, insisted firmly on seeing fair play between them.

THE SPREADING OF THE BRITISH EMPIRE INTO AUSTRALIA

No one but the British thought of going to New Zealand. But when the British landed in Australia and hoisted the British flag in 1788, over a hundred years ago, some French ships appeared. Perhaps, if they had reached the bay a week earlier, they might have hoisted the French flag first, and then Australia would have been French instead of British! However, the countries were at peace then, so England's possession was not disputed by any one. The natives of Australia were not at all like the Maoris of New Zealand; they were feeble savages when the British first went there.

Then the British found that this great land was one which was suited for breeding sheep and cattle. Later on rich gold-mines were found there; and more and more people went out and settled on the land and built cities, while the natives went into the great forests. There are no strong peoples among the Australian natives, but only little tribes which can never become dangerous except in the same way as bands of robbers. They do not make rule difficult, like the natives in Africa; still less is this land like India, where there are a thousand natives to every European. In that way Australia is more like Canada; more like a huge England without so many people.

Let us try to think what this mighty empire means—all the people who salute the British flag as their own. A million of people seems a great number, does it not? There are forty-five millions in the United Kingdom. But in a single one of the countries which it rules—India—there are over 300 millions. And there are more millions in Australia, and more in Canada, and more in Africa, and more scattered all over the world.

THE WONDERFUL LANGUAGES & PEOPLES THAT COME TOGETHER IN THE EMPIRE

There is hardly a language under the sun which is not the native tongue of a number of people who belong to the empire. You could bring together a hundred sons of the empire, not one of whom could understand a word that any of the others spoke. There is hardly a religion which does not include subjects of King George among its followers—Christians, Mohammedans, Buddhists, Hindus, sun and fire worshippers, and worshippers of strange and monstrous beings whom they have imagined for themselves as gods. There are black peoples who a little while ago were cannibals; long-haired South Sea Islanders and woolly-haired negroes; yellow skins and red skins; quite a number of different brown-skinned peoples in India alone, tall Sikhs and little Ghurkas, who love to fight shoulder to shoulder with the Highlanders; sturdy Bhils and fiery Pathans; Parsees, who come of the ancient people of Persia; Brahmins and Rajputs, descendants of the priests and warriors who conquered India five thousand years ago. And side by side with the British race in Canada are the descendants of Frenchmen bearing French names; and in South Africa, Dutchmen bearing Dutch names. They dwell in the frozen North; they dwell in the blazing tropics; amid ice and snow; under the palm and the deodar; in the lands of the moose and the walrus; in the lands of the elephant and the tiger; in lands where white children cannot grow up, and in kindlier climes where Britons can settle and make a home; in lands like the British Isles and lands as unlike the British Isles as they can be.

THE MIGHTY TRUST WHICH THEY HOLD FOR THE WORLD OF THE FUTURE

On page 854 of this book is a picture of little Walter Raleigh listening to a sailor telling wonderful stories of the things he had seen on the Spanish Main; and you could guess from the little boy's face how he was dreaming of the vast empire far over the seas which would grow and grow some day long after he was dead. It has grown up now; the British race has spread itself all over the world; it has not only made itself rich and powerful—which is a small thing after all—but it has made itself the guardian of the welfare of millions and millions of people who had less knowledge or skill, or courage; it has taken upon its own shoulders what a poet has called the White Man's Burden. They must answer for it that they have striven for the welfare of these millions honestly, thoughtfully, unselfishly.

THE BRITISH EMPIRE AND THE GREAT WAR

When Great Britain determined to go to the rescue of Belgium and entered the Great War, in 1914, all parts of the Empire rallied to the call. A small army was sent to France at once and did glorious work in those first days of the German advance. Hundreds of thousands more followed them to France. Men came from Canada, Australia, New Zealand, South Africa, Newfoundland and India, and other parts of the Empire, and citizens of the British Empire fought on every front, while the British Navy kept the seas in spite of the German submarines. Germany was especially bitter toward England and sent Zeppelins to drop bombs on the cities, but the determination of the British to win never waned. The story of what the Empire did is really too long to tell here.

THE NEXT STORY OF COUNTRIES IS ON 4297

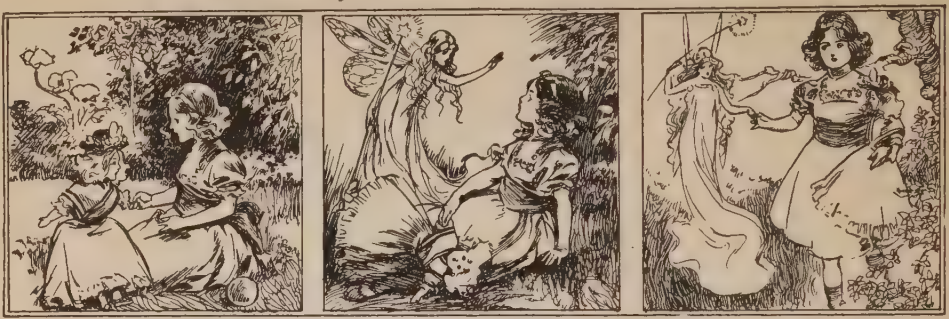
LITTLE PICTURE-STORIES IN FRENCH

First line: French. Second line: English words. Third line: As we say it in English.

Un matin une petite fille s'assit dans un jardin, jouant avec ses poupées.
One morning a little girl herself seated in a garden, playing with her dolls.
One morning a little girl sat in a garden, playing with her dolls.

Tout à coup une fée apparut. "Veux-tu aller dans le pays des fées?"
All at (a) blow a fairy appeared. "Wishest thou to go into the country of the fairies?"
Suddenly a fairy appeared. "Would you like to go to fairyland?"

"Oui!" La fée agita sa baguette, et elles s'envolèrent.
"Yes!" The fairy agitated her wand, and they themselves flew away.
"Yes!" The fairy waved her wand, and they flew away.

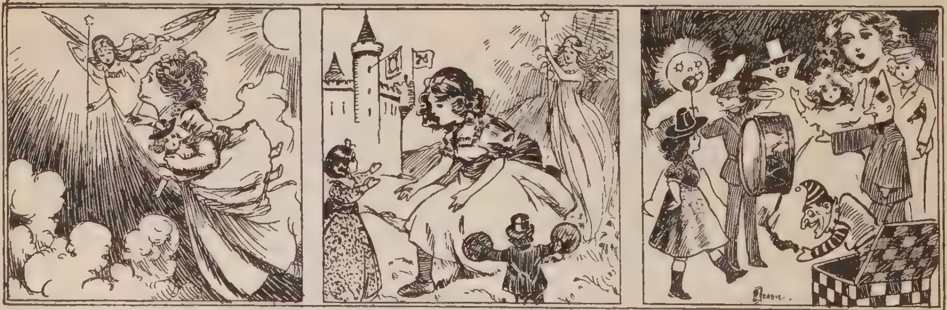


"Voici le pays des poupées!" s'écria la petite fille. "Voilà ma poupée perdue!"
"Here is the country of the dolls!" herself cried the little girl. "There is my doll lost!"
"This is doll-land," cried the little girl. "There is my lost dollie!"

"Tu m'as abandonnée à la pluie, mais les fées m'ont soignée."
"Thou me hast abandoned to the rain, but the fairies me have cared for."
"You left me out in the rain, but the fairies took care of me."

"Pauvre Bella! Es-tu heureuse dans le pays des fées?" "Mais oui."
"Poor Bella! Art thou happy in the country of the fairies?" "But yes."
"Poor Bella! Are you happy in fairyland?" "Yes."

"Que fais-tu toute la journée?" "Nous jouons, nous chantons et nous dansons."
"What dost thou all the day?" "We play, we sing and we dance."
"What do you do all day?" "We play and we sing and we dance."



"Qui sont toutes ces autres poupées?" "Des poupées qui ont perdu leurs mères."
"Who are all these other dolls?" "Some dolls who have lost their mothers."
"Who are all these other dolls?" "Dolls who have lost their mothers."

"Puis-je rester ici pour jouer avec toi?" "Demande cela aux fées."
"May I to rest here for to play with thee?" "Demand that to the fairies."
"May I stay here to play with you?" "Ask the fairies."

A ce moment une cloche sonna, et la petite fille se réveilla. C'était un rêve!
At that moment a bell sounded, and the little girl herself awoke. This was a dream!
Just then a bell rang, and the little girl awoke. It was a dream!

On the left, a kettle of liquid air standing on ice appears like a kettle of boiling water. The ice, being much warmer than the intensely cold air, changes it into gas like the atmosphere. In the second picture, liquid air is plunged into a bottle of water, and escapes with a loud, hissing sound like steam.

HOT THINGS AND COLD THINGS

CONTINUED FROM 3984

We know that matter may exist in a solid, liquid, or gaseous state, and we know, too, that, as a general rule, what we call heat makes a great difference in this respect. We take water and we make it cold, and if we go on making it cold long enough, it becomes solid. If we begin with this solid water, or ice, and add heat to it, it becomes liquid. We might say, then, that liquid water is ice plus heat—that is to say, ice with heat added. *Plus* means add. If now we add more heat to this liquid water, or, in short, if we boil it, it all disappears, and we know that it has gone into the air as water-vapor, or gaseous water.

So we can go farther and say that water-vapor is liquid water plus heat, just as liquid water is ice plus heat. If that sounds reasonable, we are already on the way to understanding what heat is, and as it is heat that we now have to study, we cannot do better than get this notion of heat as something added to matter, something that, as a rule, makes the difference between the different states of matter.

Now, the all-important question about which men have argued for ages is the question as to what this something is. We are fortunate enough, nowadays, to be able to come in at the end of the argument and get the result without the trouble of working it out. There is in heat a something that is undoubtedly real. We know there is nothing unreal about the heat of a red-hot poker. But is it a kind of matter? Is it a thing that could be weighed? Or, if not, what is it?

In the first place, it is possible to make certain that heat is not a thing which can be weighed. A hot thing, as we read upon page 3780, is no heavier than it was when it was cold. But every kind of matter has weight, because gravity acts on every kind of matter. Therefore, heat is not a kind of matter. But it is certainly something, and a very real something, and so we want to know what it is.

At one time men got out of the difficulty by inventing names. One of the greatest Englishmen of our time, George Meredith, said that "naming saves a lot of thinking"; and this is a case in point. Men said that they would call stones and water and gases, and so on, the things that could be weighed, or, to use the long Latin word, the *ponderabilia;* then, they said, we will call the other things, such as heat, that cannot be weighed, but which are certainly very real, *imponderabilia.* But, of course, these long words really tell us nothing. We are not a bit farther on when we have invented them than we were before, though in all times and places, and on every kind of subject, men are apt to think that naming carries them along the road of progress.

In our own day we have learned what this thing really is that cannot be weighed. It is motion. Motion cannot be weighed; it cannot be handled or tasted, but it is very real, as we know. We know, too, that there are many kinds of motion, and, of course, it does not do to say that heat is motion unless we add that it is a very special and particular kind of motion, quite distinct from any other. We believe that heat is a special to-and-fro motion, which we have learned to call a vibration, of the atoms or molecules of which matter is made. Now, this idea, simple enough in itself, has very startling consequences.

THE SWINGING OF THE MOLECULES THAT MAKES WATER HOT

Let us consider a simple case like that of water. Let us imagine that we have a little liquid water before us; it may be cold or hot water, but, in any case, it has a certain amount of heat in it; in other words, its molecules are vibrating at a certain rate and, as we may suppose, with a certain length of swing to each vibration. Now, if we add heat to this water, we are adding to it—on our notion of what heat really is—more motion of this particular kind. Well, when the molecules of the water get this extra motion added to them—perhaps taking the form of a quicker motion, or perhaps taking the form of a longer swing, or perhaps both—the time comes when it is simply impossible for the molecules to swing so freely or so quickly, and yet to hold together in the way that makes liquid water. With so much heat in it, the water has to become gas, other things being equal, and it does so. It boils. This water-vapor, as it now is, may have still more heat added to it, nor can we say what limits there are in this direction.

But now let us travel in the other direction. Instead of adding heat, which is a special kind of motion, to the water, let us begin to take from it the heat that it already has. We know that, when we cool the water, in course of time it turns solid. Other things being equal—and we have to say this because the question of the pressure of the atmosphere really comes into this too—the molecules of the water can no longer be related in the way that makes the water liquid, if we take away from them too much of that particular kind of motion which we call heat. Deprived of much of this motion, the molecules have to arrange themselves in a different way, so that we have what we call ice.

ICE THAT CAN BE COOLED AND ICE THAT CAN BE HEATED

Now, though we all agree that liquid water may be hotter or colder, because we notice this every day, perhaps we are not all quite sure that ice may be hotter or colder; yet it certainly may. We can cool the ice as we cooled the water, and all the time we are taking away from it this particular kind of motion called heat; and so we may go on and up to a certain point.

Now, if a man has a certain amount of money, it may be added to, and there is no particular point at which no more can be added, and so it is with the addition of heat to anything. But if we start taking away a man's money, say, at the rate of one penny after another, the time is bound to come—and bound to come whether he started with a penny or with a million dollars—when he has no more money to lose, and, whatever we do to him, we cannot make him lose any more.

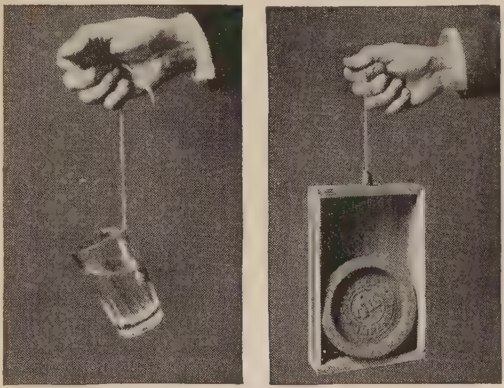
Now, what is true of money must be true of anything else, such as the kind of motion we call heat. As we cool the ice, we are taking this motion away from it, but the amount of it that the ice has is not infinite, and in course of time, if we go on steadily—though this may be tremendously difficult or impossible—we shall take away all the heat that was in the ice, and we shall have something which is absolutely cold.

HOW ICE CAN BE MADE SO COLD THAT IT CAN BECOME NO COLDER

There is now no heat in the ice; the utmost part of the kind of motion we call heat has left it. So far as that kind of motion is concerned, its molecules and atoms are still; they cannot be colder. If heat is such as we suppose, this must be a possibility for matter of all kinds, whether ice or anything else. Further, it is possible to find out how cold a thing would have to be so that it could be no colder, and we do indeed know what that point is compared with our ordinary scales of temperature, about which we have already learned something. In various ways it has been shown that 273 degrees below zero on the centigrade scale is absolute cold. Matter reduced to that point would have no heat in it. Nothing can be colder than this. This discovery is one of the greatest that has ever been made in this part of science, and it has many interesting consequences, as we shall see.

First, let us consider the matter of measurement, always so important. We now have something better to go by even than the freezing-point and the boiling-point of water; we have something even better than the freezing-point of mercury or, indeed, of any substance that we know. We have discovered the existence of a point at which what we call heat has ceased to exist.

Plainly, that point must be nothing, or zero, on the best possible scale of temperature. So, while there is a zero on the centigrade scale, and on various other scales, we now have discovered the *real zero*, where heat and temperature really begin; and this we call the *absolute zero*. All over the world, men of science are rapidly learning to think and write in terms of this real scale of temperature.



A leaden bullet tied to a string is dipped in liquid air, which makes it so cold that when the bullet is placed in water it freezes the water, and a tumbler can be suspended by the bullet, which freezes to the side of the glass, as in the first picture. On the right, a box containing a weight has a recess at the top filled with mercury. The cold bullet placed on the mercury freezes it, and the box is suspended like the glass.

Any student of heat, going to lectures, or reading text-books, will find such phrases as "10 degrees absolute." The ordinary clumsy way of expressing that point on the scale would be "minus 263 degrees centigrade," and, of course, we can see at once what a great advantage it is to reckon on the new scale. It is a great find for science to have discovered Nature's zero of temperature instead of having to fix on some point far above that real zero, and then to call that point the zero because we know no better.

The next question which must occur to everyone who thinks about this is: What is matter like at absolute zero? Let us imagine what this means. We have taken a gas, such as water-vapor or hydrogen, the molecules of which are moving about in a particular way, which we call heat. We have steadily taken away that motion; the gas has steadily become colder, first liquid and then solid. When we have taken away all the motion of this kind, what will be left? We must remember that the substance we are dealing with has steadily shrunk all the time; indeed, not merely part of its size, but by far the greater part of its size to begin with, was due to the heat in it. If now, as we cool it, its size begins to lessen, is it not quite possible that when we have made it absolutely cold there may be nothing left of it? This was at one time believed in and we can see that it is not unreasonable. But now we believe that, even at absolute zero, matter would not disappear; in other words, heat is something added to matter, but heat is not matter. So, when all the heat has been taken away, there is still matter left, though it is not at all in the same state as with the heat added.

In the last paragraph it was said "we believe," and that has to be said because the correct answer to the next question, "Has matter ever been reduced to the absolute zero?" is No. So that we cannot yet say for certain. However, we have a great deal of evidence which makes us entitled to say that matter would not disappear at the absolute zero, even though we have never succeeded in reaching that point yet, and possibly never shall reach it. In the first place, it is believed by astronomers that in the mighty tracts of space between the stars and planets there are quantities, by no means small, of matter, such as is often called *cosmic dust*. Now, students of heat are convinced that in these great spaces the temperature must be practically that of the absolute zero, the coldest possible cold. Therefore, the existence of this temperature does not mean that matter disappears.

In the second place, we have the evidence provided by our own little attempts on the earth to reach the absolute zero. Let us now see how far down the scale man has been able to go, and what results he obtains.

It is by no means a difficult thing to make carbon dioxide solid, and then it looks like a sort of very cold snow. After all, snow itself is only solid water-vapor, and the two cases are quite parallel. It is very much more difficult, but still it is possible, to take the mixture of gases which we call air, and first of all to make it liquid by cooling it very much, and then by cooling that liquid still more to make it become quite solid.

THE GREAT MARVEL OF LIQUID AIR THAT CAN BE POURED OUT LIKE WATER

Perhaps the greatest work of this kind has been done by Sir James Dewar, at the Royal Institution in London. Liquid air is vastly colder than ice, and it looks like water. It can be stored quite easily in vessels, and poured about just like water. A few drops running over our fingers would do them no harm, but, of course, we should not put our fingers in it, and the consequences of drinking it, which has been suggested, are too terrible to think about.

The use of liquid air is one of the most convenient ways for making low temperatures—that is to say, for making other things cold—and it is now very largely used in chemistry for this purpose. There has also been recently made a device whereby a rescuer going down into a coal-mine, in order to try to save the victims of an explosion, could carry liquid air down with him, and then, as it evaporated, he would have it to breathe. The suggestion has also been made, by the present writer, and doubtless by other students of the subject, that liquid air might be used, when it has become much cheaper than it is, as a means of ventilation. It would make rather a cold kind of ventilation, but probably nothing could be better if it were cheap enough. Of course, liquid air is always very much colder than anything around it, and this means that the kind of motion called heat pours into it from outside, and, as this happens, the liquid air evaporates, and turns into ordinary gaseous air again.

A PIECE OF SOLID AIR THAT CAN BE SEEN

No one could tell by looking at it that liquid air was not water, and when it is frozen no one could tell it from ice by looking at it. Solid air is, of course, very much colder than liquid air, but it is very far from having reached the lowest temperatures.

By the use of liquid air, and with the aid of very strong and expensive machinery, it is possible to liquefy all the gases that are known. It was a great triumph when the lightest of all the gases—hydrogen—was liquefied; and from liquid hydrogen there can be obtained for a few seconds solid hydrogen. Latterly, success has been obtained even with the gas helium, which had resisted all previous attempts; and this also has been liquefied.

Now, the question is: How low down in the scale do we get with such gases as these? The answer is that in the last few years steady progress has been made, and, instead of having to be content with, say, 14 degrees or 12 degrees absolute, we have got down to as low as 5, 4, and perhaps for a moment or so even just below 3 degrees absolute. Of course, when we say 3 degrees absolute, we mean 270 degrees below the freezing-point of water on the centigrade scale. Now, at first it sounds as if the great goal which all chemists desire will soon be attained: if we have got to within 2 or 3 degrees of the absolute zero, we can surely conquer the short distance that still remains; but of this we are not so certain.

THE TREMENDOUS DIFFICULTY OF GETTING ALL THE HEAT OUT OF A THING

In the first place, though 2 degrees or 3 degrees is not much in our ordinary way of thinking, yet that partly depends upon the way in which our minds are deceived by figures. If we chose a much finer reckoning, and divided every degree into a thousand degrees, then the interval between solid helium or hydrogen and the absolute zero would sound much larger.

Then, again, it is the fact, and one which applies in many instances in science, that the farther we go the slower we go. We might suppose that to travel from 12 degrees absolute to 8 degrees would be just the same as to travel from 8 to 4 or from 4 to zero; but that is very far from being the case. Every degree lower is much harder to conquer than the one before.

Two illustrations will help us to understand this, though at first sight they seem absurd. There is first the excellent illustration, which we should all know, of the man who owed another man 32 cents and paid him first 16 cents, then 8 cents, then 4 cents, and so on, each time halving what he paid. Now, in a very short time the man to whom the 32 cents was owed got 31 cents; but not in the course of all eternity would he get the whole of the last cent, even though he got an instalment on these terms every second. Look at it from the point of view of the man who is trying to get the whole 32 cents, and we see that, as each time he is only getting half of what remains, however long he goes on there must always be left behind as much as he got last time.

Flowers placed in liquid air become frozen, and as brittle as glass, in a few moments.

Now, suppose that, instead of trying to get 32 cents out of a man, we are trying to get all the air out of an air-pump, and suppose that, just as the creditor got 16 cents when 32 cents was owing to him, and 8 cents when 16 cents was owing to him, so in this case every time we work the pump we withdraw half of the air remaining in the space we are trying to empty. We shall soon make it very empty indeed; but if we go on for ever on those terms we shall never empty it, because, however little remains before each stroke of the pump, we only get half of that out, and so it would go on always.

These illustrations help us to understand that it is more easy to conquer a hundred degrees downwards from the freezing-point of water than it is to conquer the last degree or two in the attempt to reach the coldest cold; and, indeed, it is probable that we shall never completely succeed. But a great deal has already been done, and it is extremely valuable indeed to go no lower than the temperature of liquid air, as the attainment of that has put into the hands of the modern chemist an instrument of the highest usefulness.

One of the most interesting and important discoveries which we make when we study low temperatures is that the ordinary processes of chemistry are greatly changed. It seems, indeed, that by far the greater number of ordinary chemical processes, such as happen when a fire is burning, or such as those which are always going on in our own bodies, can only occur within a certain range of temperature. It is believed, for instance, that at the temperature of the sun things are too hot for any chemical processes to occur—that an atom of one kind cannot there combine with an atom of another, and, in consequence, there are only elements in the sun and no chemical compounds.

When we descend instead of ascending, the same result is, in general, true. Just as chemical processes cease at high temperatures, so most of them cease at very low temperatures. Elements which ordinarily combine with each other with great force, and perhaps explosive violence, do nothing at all with each other when put together at very low temperatures. Nevertheless, as Sir James Dewar and the great French chemist Moissan have shown, there is also a low-temperature chemistry about which we know practically nothing as yet, because hitherto no one has been able to study it, and we did not know that such temperatures existed. This low-temperature chemistry has its own peculiarities and limitations, and when this new world of chemistry has been explored, it is certain to yield results of the greatest importance to knowledge generally.

THE GREAT HEAT THAT DESTROYS EVERY LIVING THING

It is of the greatest importance to study the relations of the extremes of temperature to life. Every living thing that we know has a certain range of temperature in which it lives best. Now, we may take a living thing, and we may study the effects of heat on the one hand, or cold on the other. The first general rule we discover is that heat is very fatal.

No living thing we know can survive the temperature of boiling water for any length of time. Certain microbes, if they happen to have covered themselves up with a thick coat for the time, may stand the temperature of boiling water for a minute or two, but that is all. Now, though boiling water is hot, its temperature is nothing at all compared with that of an ordinary flame, much less that of a furnace or the sun. We see, therefore, that the upward range of life in regard to temperature is very short indeed. Of the thousands of degrees upwards that can easily be attained, only a few tens have to be passed before life is destroyed.

The contrast when we go in the other direction is extraordinary. It has long been known that fish, microbes, and plants of various kinds will stand a great degree of exposure to ice without being killed.

MICROBES THAT STOP LIVING AND BEGIN TO LIVE AGAIN

But probably no one would have guessed the fact, which was proved at the Royal Institution a few years ago, that microbes which could not live for five minutes at the temperature of boiling water can be kept in liquid air for as long as six weeks on end, if not longer, and yet be found alive. This very remarkable discovery can now be explained almost with certainty. We are not to suppose that the microbes live at their ordinary rate and in their ordinary way while they are being subjected to this terrible cold. They seem, as it were, to stop living for the time, but they do not die. That upon which their life depends is not destroyed, and therefore when they are taken out of the liquid air they can start living again, so to speak; though while they were in it the cold was far too great to allow those chemical changes upon which life depends to go on.

We are learning that life depends upon *ferments*—very complicated chemical compounds which have the extraordinary power of starting and keeping up chemical processes in the things around them. Every known ferment is very easily destroyed by heat.

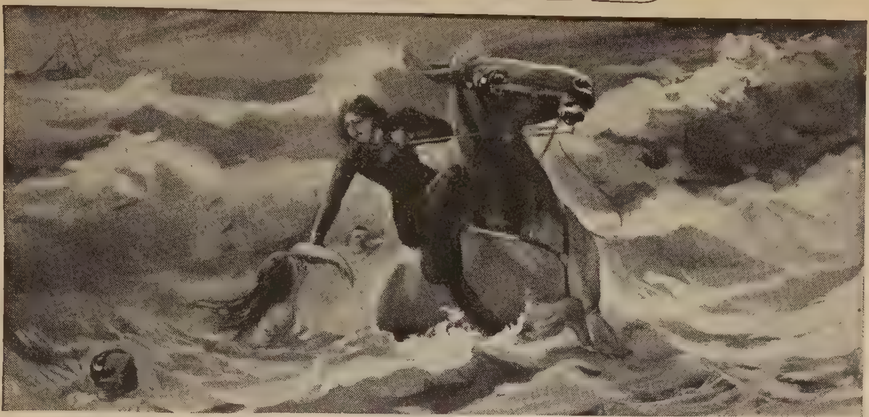
If we take a little pepsin, the stomach ferment, or any other, and boil it for a minute or two, it will never do any digestive work again. Here we see the reason why living things are so quickly destroyed by heat. They are killed because the ferments, without which they cannot live, are simply broken up by the heat, and when they are cooled down again there is no recovery, for these ferments are gone; and without ferments new ferments cannot be made. That is the great wonder of them.

WHY IT IS BAD FOR BOYS AND GIRLS TO EAT TOO MANY ICE CREAM SODAS

But take the case of the low temperature, and apply what we have already learned to it. The microbes that we take and bury in liquid air depend for their life—as do all living things—upon the ferments they contain. When heated, those same microbes would be killed because the ferments were destroyed. But cooling does not destroy a ferment; it merely stops the action of the ferment; digestion cannot go on in the cold. That is why it is bad for little boys and girls to eat too many ice cream sodas.

Therefore, as life depends upon the action of ferments, and as ferments cannot act in the cold, we cannot say that the microbes in liquid air are actually living, or, if they are living, they are, at any rate, "not doing anything at it." Yet, as we find afterwards, they are not killed, and the reason is that, though their living has been stopped for the time, the things upon which life depends have not been destroyed.

THE NEXT PART OF THIS IS ON PAGE 4229.



A WOMAN'S RIDE IN THE SEA

CONTINUED FROM 4027

Battling with the fierce winds and heaving waves in the effort to save life is hard work for strong men, and yet how many times have brave women risked their lives and faced the most appalling dangers in order to rescue men and women and children from a watery grave.

Some years ago a lady, named Miss Grace Bussell, who lived at Wallscliffe, in Western Australia, was reading in the drawing-room of her father's house, when a native servant rode up to the front door to say that a ship had been wrecked about seven miles down the coast, and was fast going to pieces on the rocks. A hurricane was blowing at the time, and the sea was lashed into a fury by the fierceness of the wind.

Without a moment's hesitation Miss Bussell ran to the stable, and, jumping on her father's horse, a fine animal, galloped off down the coast with the servant. The ship was about two hundred feet from the shore, and the waves were dashing over it in such a way that it was clear the vessel could not hold together very long.

The crew attempted to land some of the passengers in the ship's boat, but the boat had scarcely left the wreck when a large wave caught the little craft as though it were a cork and turned it right over, so that all the occupants were quickly hurled into the sea.

It was at this moment that Miss Bussell arrived at the spot directly opposite the wreck, and she immediately dashed into the angry sea and guided her brave steed towards the place where the people were struggling in the water. The servant followed her on his horse, and together they managed to bring a large number of the half-drowned people in safety to the shore.

Again and again Miss Bussell went out to battle with the storm and waves, and it was only with the greatest difficulty that she could keep her seat upon the horse's back. But each time she managed to reach the struggling victims of the wreck, and, swimming hither and thither among them, enabled some half-dozen or so to cling to the saddle or horse's mane and tail, and so assisted them to the shore.

The risk was very great, and on each occasion that Miss Bussell turned her horse's head towards the wreck, after bringing a party to land, it seemed that she could never succeed in her purpose. Still more impossible did it seem that she could ever reach the shore again with her living load. But her pluck and determination and skill, and the strength and endurance of her fine animal, enabled her to perform the apparently impossible; and by dint of these repeated exertions the passengers and crew were, in due time, saved, including the men and women and the little children who had been on board. The last man was saved by the servant, Samuel Isaacs, who swam his horse out and rescued him just as he was about to sink.

Once, when Miss Bussell was bringing five or six exhausted people to shore, her horse's legs became entangled in a rope, and it looked as though nothing could save the party; but by clever handling Miss Bussell saved the animal from being washed over on to his side, and he was able to get his legs free of the rope. The medal of the Royal Humane Society was presented to the gallant lady for the bravery and courage she displayed on this occasion. Had it not been for her prompt and plucky action there would have been little hope for the passengers and crew, for on this part of the Australian coast there was not, at that time, any proper life-saving apparatus provided.

A BRAVE BOY'S REMARKABLE SWIM

FEW names are more honored in the annals of the British Navy than that of Sir Cloudesley Shovel, whose remains lie buried in Westminster Abbey. This brave but ill-fated admiral lost his life on a foggy October night in 1707, off the Scilly Islands, when his ship struck upon a rock, and went down with 800 men on bard.

When a boy, young Shovel, whose parents were very poor, was apprenticed to a shoemaker; but he disliked the trade, and, having a longing to go to sea, he ran away, and was engaged as cabin-boy on a warship. Those were times of stress in the British Navy. England was at war with France, and it was not long before the boy saw active service.

He determined to make himself thoroughly proficient at his duties, and although as cabin-boy he had plenty of work to do, he still found time to study the principles of navigation. He was very brave, and his pleasing disposition endeared him to both the officers and men of the boat on which he sailed, for he was always ready to do anything for anyone, whether it were part of his regular duties or not.

During an engagement, young Cloudesley Shovel was on board a vessel upon which was the British commander, Sir John Narborough, and Sir John expressed an earnest desire that means might be found of conveying some important orders to another ship that lay a considerable distance away.

None of the older officers or men could offer any suggestion; but the boy, having overheard his commander's wish, approached Sir John Narborough, and begged that he might be allowed to carry the despatch. The officer looked at the boy in surprise, for it was hardly likely that a boy would have any useful or possible plan where able and experienced seamen failed.

"And how do you expect to get to the ship ?" he asked.

"By swimming, sir," was the prompt reply.

"But the enemy are firing heavily all round, and it will be a very dangerous task."

"If I may be allowed to go, sir, I will undertake to carry the despatch safely to the ship."

Sir John Narborough was pleased at the confidence and bravery and energy shown by the boy, and, giving him the important document, he bade him make the attempt.

Cloudesley Shovel divested himself of nearly all his clothes, then, taking the despatch in his mouth, he jumped into the water, and struck out for the other ship. The path lay across the enemy's line of fire, and the shots were striking the water all around. But, by what seemed a miracle, he escaped, and, swimming hard all the time, he at last reached his destination, and was able to deliver the despatch safe and sound.

It was indeed a remarkable feat for a boy, and Shovel soon rose to be an officer, and eventually an admiral and a knight. In addition to many exploits in regular warfare, he did much good in suppressing piracy in the Mediterranean Sea, at a time when the people of the Barbary States lived largely by preying upon the commerce of other nations.

In 1674, as a lieutenant under Sir John Narborough, he punished the pirates very severely at Tripoli, burning four of their ships under the very walls and castles of their stronghold.

A BOY'S LOVE FOR HIS MOTHER

JEAN VIGIER'S mother was a widow with four sons, whom she found it difficult to bring up and to educate, for she was very poor. Kind friends found situations for the three elder sons, but the youngest, Jean, a clever, promising boy of nine and a half, they wished to keep at school. Yet they could not afford to do that and help the weakly mother at the same time; so it was decided that she must go to the poor-house, while Jean stayed at boarding-school. Then the curé invited the boy to his house to tell him of this decision.

Now, Jean was rather inquisitive, and, when left alone for a few minutes, he looked at a paper on the curé's table, and he found that this paper was an order for his mother's admission to the poor-house. Alarmed, the boy ran out of the house and back to school, where he put on his working suit. Then returning to the curé, he said: "I know it all; but mother shall *not* go to the poor-house. I am going to stay with her and support her."

The curé tried to reason with the boy, and pointed out that in the end it would be better for his mother if he were well educated, for then he could earn more money than if he remained ignorant. But Jean was ambitious to help his mother, and when he found his brothers were unwilling to help him, he sold his clothes and a watch he had received as a reward at school, and, with the proceeds, bought cakes and toys, which he hawked about the streets of Aurillac.

People liked to buy of the bright little fellow, especially when they knew how he loved and cared for his mother; and he prospered so that he was soon able to earn enough to support himself and her.

THE LOVE THAT IS STRONGER THAN DEATH

IN the turbulent times that followed the death of Julius Cæsar, Cicero and his brother Quintus were both placed upon the secret list of those who should be put to death. Learning of their danger, they fled from Rome, and had gone some distance towards the coast, when they suddenly remembered that they had very little money with them.

Quintus thereupon undertook to return to the city for the necessary means, while Cicero proceeded on his flight. Arrived at Rome, Quintus made his way to his house, but his return was soon known, and soldiers were sent to kill him. He managed to conceal himself so well that, although the assassins searched the house, they could not find him.

This enraged them so much that they seized the son of Quintus, and put him to the torture to make him disclose his father's whereabouts. But although the pain was terrible, and the cruel torturers spared no means that their wicked ingenuity could think of, the brave young Roman remained firm, and absolutely refused to say where his father was hidden.

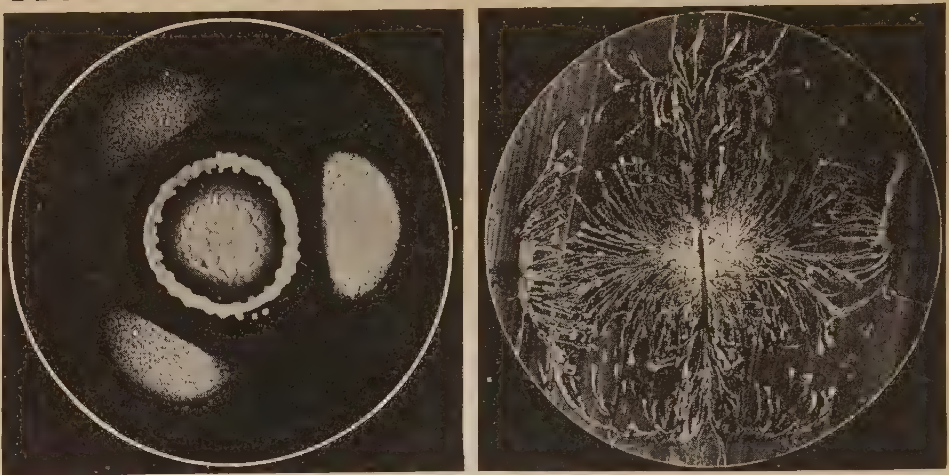
Again and again they applied the torture, and at last from time to time a groan escaped the suffering youth, which reached his father's ears. Quintus endured the agony of hearing his son's sufferings on his behalf for a little while, and then, running from his hiding-place, he surrendered to the soldiers, and begged them, with tears in his eyes, to kill him, but to spare the innocent youth who had done no harm to them or to their master.

But such a thing as pity was unknown to these base murderers, hired to do the wicked work of men as evil as themselves, and they only mocked at the father's prayers and the son's pain. They must both die, they declared: the father because he had been condemned, and the son because he had tried to conceal his father.

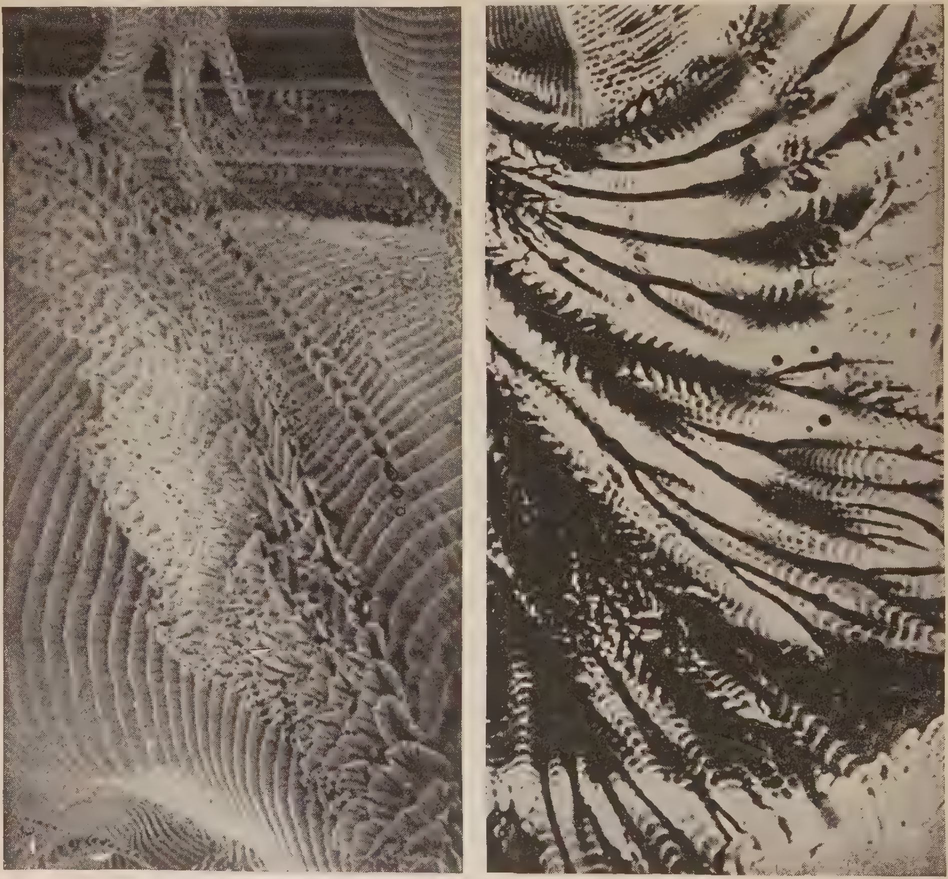
The unhappy pair accepted their fate with gallant resignation, but they now disputed as to who should suffer first, each desiring to be the first victim, so that the other might be spared a few moments more of life. The cruel assassins, however, settled the matter, and saved them both from the agony of surviving the other, even for a moment. The murderers divided themselves into two groups, and beheaded father and son at the same moment. Few more pathetic and inspiring instances of the mutual devotion of father and son are to be found in all history.

THE NEXT GOLDEN DEEDS ARE ON PAGE 4191.

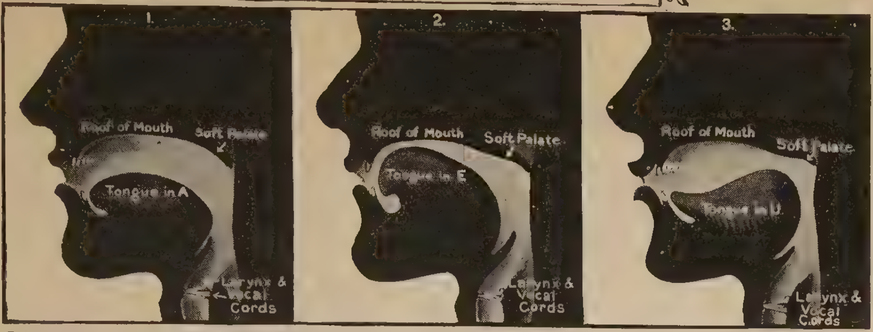
PICTURES DRAWN BY THE HUMAN VOICE



No artist drew these designs. A thin sheet of rubber was stretched over a vessel like a cup which had a spout at the side. Some light powder was thrown upon the rubber covering, and when someone sang into the spout, the powder formed itself into the design of the picture on the left. The right-hand picture, which looks like a frosted window, was drawn in the same way, but moist paint was used instead of powder.



To obtain the left-hand picture, a sheet of glass was coated with paint and put over the cup, with the paint resting on the rubber covering. Then, as the spout was sung into, the glass was moved round, and this design appeared. The picture on the right—something like a fern-leaf—was made by singing louder and using moister paint. The cup with a spout or tube is called an eidophone, which means "form of the voice."



Here we see the positions taken by the tongue and lips when different vowels are pronounced. The position of the larynx remains the same, the different sounds being produced by the changed position of the resonators, or cavities above the larynx. The vowels shown are A, as in father, E, and U.

TALKING AND SINGING

CONTINUED FROM 4002

WE know how the larynx, or voice-box, the musical instrument which we all possess, produces notes of any particular pitch that we desire. But though singing is very delightful and precious, and though many books might be written upon the voice-box and its use in singing, speaking is really much more important than singing, and therefore it is necessary to study speaking from the point of view of the machinery by which it is done.

We have already learned about the wonderful centre in the brain where words and the meaning of them are stored, and we understand that everything else depends upon the orders given there, but now we must go on to study the machinery by which those orders are carried out. The voice-box is, of course, the central part of this machinery, but it is not all; and, indeed, everyone knows, who has whispered, that it is possible to speak without the voice-box at all.

There is one point which has been greatly discussed by many thinkers, and which we must mention first. We know that we ourselves both speak and sing, and when we observe the birds, we find that they sing, but do not speak. The question is: Did singing or speaking come first? And there is a difference of opinion on this matter. A great Frenchman, named Diderot, at the end of the eighteenth century, and Herbert Spencer, many years after, supposed that singing came later than speaking. Their argument was that, after learning merely to speak, the time came when men wanted to make their speech more effective and thrilling and moving, and so they sang the words instead of only speaking them. So on this theory speech came first, and song is a sort of speech with more effect added to it by the addition of music.

But against these great opinions there is another great opinion—that of Charles Darwin. For many years he studied the expressions of feeling in man and in the lower animals. He found, as he thought, that many of the lower animals, especially the birds, sing of set purpose, so to speak, and perhaps sing very beautifully. He supposed that the special reason for the song of animals was to call each other and to please each other. Now, on this view, song came first with the animals, and speech afterwards with man, and that is what Darwin maintained.

This is a subject which the writer of this story has specially tried to study, and what he thinks is that in the case of mankind speech and song have arisen together. They are really two varieties of the same thing, which is expression by means of the voice. The argument of Diderot and Spencer that speech came first and song afterwards is not supported by the fact that, when we observe the growth of very small children, we can see the beginnings of speech and of singing growing up at one and the same time in them; nor is there any reason at all why this should not be the case. However this may be—and it is at least an interesting subject to think about—let us now go on to study what happens when we speak.

WHY IT IS THAT WE USE DIFFERENT NOTES IN SPEAKING

First of all, let us discover what is the difference between singing and speaking. In both cases we produce sounds by means of the voice-box, except in whispering; in both cases these sounds are musical notes—that is to say, the waves which form them are regular; in both cases there are changes of pitch.

No one speaks with his voice all the time on the same note, even in the shortest sentence. We raise the voice sometimes, we lower it at other times, as we go along, and we convey a great deal by the way in which we do this; so much so, that children or foreigners, who do not understand the words we are saying, may learn a great deal from the pitch of the notes we use.

Even a dog or a horse will learn much from our voices in the same way. If anyone doubts that we use a number of different notes when we speak, let him get someone to say a sentence all on the same note, without raising his voice or lowering it. The Greek word for one is *monos*, and so, when something is spoken or sung all on the same note, we say that it is a monotone, and thus we get the word monotonous.

HOW WE ARE ABLE TO PUT COLOR INTO OUR VOICES

We could scarcely live with anyone who spoke in a really monotonous voice. Also, we use different loudnesses when we speak, and, apart from the actual note we are speaking on, we use different kinds of what is often called color in our voices. We speak to a child in a more tender tone than we speak to a bus conductor, though we may speak more loudly to the child than to him. There are many different shades of expression which we can put into the same words spoken on the same notes and with the same loudness.

Now, the reason why it has been necessary to go so carefully into this is that we want to find out the difference between speaking and singing, and the first thing we find is that in all real points the singer does no more than the speaker does. He uses a variety of notes, he uses a variety of force, he uses a variety of colors. It may be added also that both singers and speakers use a variety of rhythm and speed.

But, nevertheless, no one will say that speaking and singing are the same, and everyone knows what it is to hear someone speaking in a sing-song voice. There is a common English word which has a very interesting history that bears on this point. It is the word cant. We say that a thing is cant or that a person is canting when we mean that he is professing high ideas that he does not really believe. The word comes from the Latin *canto*, I sing. Cant and chant are really the same word, and we might as well say that a person is chanting as that he is canting.

WHAT HAPPENS WHEN ANYBODY SPEAKS IN A SING-SONG WAY

The explanation is that at a very interesting time in the history of England there were certain people, having very strict views on many things, who had the habit of speaking in a sing-song way. When they spoke they chanted. Their enemies said that they did not believe what they professed, and so the word cant, which really means singing, came to mean insincerity.

Now let us ask what it is that happens when a person, who was speaking in the ordinary way, speaks in a sing-song way, or actually sings. What happens is that he now produces notes which have fixed regular intervals between them, like the notes on a piano. When we speak we do not use the fixed musical intervals of pitch, but slide the voice up and down, without taking any notice of the fixed intervals of music at all. It is true, also, that as a rule, when we speak, we may keep our voice within the limits of, perhaps, half an octave or less, while when we sing we may range over a couple of octaves or more. But though this is evident directly we think about it, it is not the real difference between speaking and singing, which is that in singing we use only notes with fixed intervals between them, while in speaking we let our voice rest just where we please. If we think of a violin, we can, perhaps, understand this better. A player gets definite notes on the violin, such as the notes that are on the piano, by placing his fingers firmly on the strings at fixed intervals.

One of the great problems for the player is to get his fingers always at exactly the right places on the string. Now, when we sing, it is as if we were using just those intervals, only that, as we have seen, we do not get our notes by the violin player's method, but by tightening or loosening our vocal cords. If we do not use these intervals when we sing, people say that we are singing out of tune, and go out of the room as quickly as possible, and we are only asked to sing by people who have never heard us sing before.

WHY DIFFERENT PEOPLE HAVE DIFFERENT KINDS OF VOICES

But the violinist can also move his bow across a string and make it sound, while, at the same time, instead of stopping the string at certain intervals, he slides a finger right along the string. So, as the string gets gradually longer or shorter, he produces a series of notes—thousands in number really—which cannot be imitated on the piano. Now, our vocal cords can have any tightness or slackness, and so it is possible for us to pitch our voices, as we speak, at any point we like just as if the violinist were to stop moving his finger at *any* point along the string of his instrument.

One of the great differences between voices is in the person's choice of the notes on which he speaks. It might be supposed that if one did not sing, it would be all the same what notes one used; but we all know that there are people to whose speaking voice it is a real delight to listen. It may be noticed sometimes that well-trained singers, who sing quite well, but are not really musical, speak unmusically, and everyone knows cases of people who do not sing at all, but who have most beautiful speaking voices. To people with sensitive ears there is scarcely a greater delight in life than to be surrounded by people with beautiful speaking voices, and one of the reasons why we ought to study this question here is that we are running a grave risk to-day of losing the beauty of our speaking voices, and for several reasons.

THE GREAT CARE THAT SHOULD BE TAKEN OF THE VOICE IN LARGE FAMILIES

One reason is simply the way in which we crowd together. It is probably safe to say that more pleasant speaking voices come from small families than from large ones. If we are one of twelve children, and we want to be heard—well, we are rather apt to discover which is the most piercing tone we can produce, and then, perhaps, we use that all the rest of our life. People should take great care of their children's voices in this respect, especially when there are many children, and they all want to speak at once and be heard.

Perhaps it would be a good rule to listen first to the one who spoke most quietly and nicely. We have a little girl who can speak nicely when she tries, and we call that voice, after her real name, her Monica Mary voice; she also has a less pleasant voice which she uses when she is rather cross, and we call that her Jezebel Jones voice, after the name of the naughty little girl whom we suppose also to live inside her skin. Now, the rule—and a very good one—is that she never gets anything when she asks for it in the Jezebel Jones voice, but that we do our best when she uses the nice one. Long after we are gone, perhaps people will be grateful to us for having encouraged her to speak with a beautiful voice that gives pleasure and rest and peace to the people around her.

THE NOISES OF GREAT CITIES THAT ARE SPOILING THE MUSIC OF OUR VOICES

A second special reason why voices lose their beauty is the growth of cities and their noises. The louder the noises around us, the louder and more piercing our voices have to be, and the music of them deteriorates, both in the quality of the notes and in the pitch of the notes. When there is a noise going on all around us, we have no time to make our voices pleasant; we have to be heard. This question of noise naturally affects very much the voices of different classes of people. A person who speaks in a high-pitched, harsh tone—as if he scarcely expected to be heard, but meant to have a try—tells us something about himself and his surroundings. Contrast that with the woman who speaks in a voice rather low-pitched, quiet, and musical. In so doing, she almost tells us—does she not?—that she is accustomed to live in surroundings of peace and quiet where people do not interrupt each other, where no one shouts, and that she, indeed, would rather not be heard at all than make distressing noises. In perhaps the most heartbreaking scene he ever wrote, Shakespeare makes poor King Lear say of his daughter Cordelia: "Her voice was ever soft, gentle, and low, an excellent thing in woman."

To some children who read these words, this may appear not very important; but if we wait until we are unhappy, or until we are ill, or until we have to live with one and the same person all our life, then we shall find out what a difference it makes.

THE GREAT VALUE OF CULTIVATING A SOFT AND GENTLE VOICE

There are doctors and there are nurses who are worth far more than others are to their patients, not because they are cleverer or more conscientious, but because they have the kind of voice that often goes half-way to making a sick person well.

If the quality and use of the speaking voice were entirely a matter of the shape of the larynx, or voice-box, itself, then it would be quite useless to discuss this question; but, in point of fact, the results depend upon deeper things than these, and very often the voice expresses nothing less deep than character. Children are wise in this respect, and often make very good judgments about people by their voices.

Every year hundreds of thousands of dollars are spent on singing lessons and on listening to singers. That is all very well in its way, but it is a curious thing that so few of us trouble at all about speaking lessons or about making any conscious effort at all to speak nicely. Parents will cheerfully spend large sums of money on having their children taught to sing, and will, at the same time, allow those children to talk regularly in a way which would distress any dog. We already know upon what the pitch of the voice depends, and we know, too, that a tone of any given pitch may have different shades of color, or quality. This is, at first, not easy to understand, but it becomes clear as we study sound in the STORY OF THE EARTH.

WHY WE CAN SING THE DIFFERENT VOWELS ON THE SAME NOTE

The fact is, that when we speak or sing on a given note, that note is really a mixture of a large number of notes. The lowest of these is the principal one, and is the one we hear best. But mixed up with it there are several others, called over-tones, which color it and give it its quality.

Now, we all know that it is possible to speak or sing any of the vowels on the same note. When we read this, we should quietly say or sing *a*, *e*, *i*, *o*, *u* to ourselves on the same note—and, of course, these are by no means all the vowel sounds that there are. Now, if these are all on the same note, what makes the difference between them? The whole difference between the vowels consists of a difference in the number and proportion and comparative loudness of the over-tones. When we sing *a*, *e* on the same note, the difference is that when we make the *e* we do something which alters the over-tones that made *a;* and so, again, when we change the tone to *o* or to *ah*, or to any other.

If we carefully notice when we do this, we shall feel that something is happening inside our mouths. We are moving our throat in a different way; we change the position and the shape of the tongue, or, in some cases—as when we change the sound to *o*—we move the lips.

HOW WE CAN MAKE DIFFERENT SOUNDS BY MOVING THE VOICE ORGANS

In all these cases the larynx is unchanged, and the vocal cords are just doing what they did at first; but we are altering the shape of the spaces above the larynx—the *resonators*, as they are called—and so the over-tones are changed, and, instead of the particular set of over-tones which we have agreed to call *a*, there comes another which we have agreed to call *e*, and so on.

Children learn to make these sounds by imitation. That, by the way, is no explanation of how it is done, but still it is done. Now, youth is the time for learning, and afterwards not only is it difficult to learn new things, but also it is difficult to unlearn what we learned in youth. Different languages have different vowel sounds. Probably, on the whole, none of them is more difficult to learn to pronounce than any of the others. The question is really at what time in our lives we are asked to do so.

Every nation calls the sounds of the words of every other nation jaw-breaking for this reason. In English, for instance, we do not have the vowel sounds represented by the German *ü* or *ue*; nor has our *o* exactly the same sound as the Italian *o*. So we find it very difficult to make those sounds when we try to speak those languages, and, as a rule, we do not make them rightly. We may talk very good German or Italian, but the German or the Italian knows very well that these are not the languages we learned from the cradle.

WHY A FOREIGNER CAN NEVER SPEAK ENGLISH PERFECTLY

In just the same way, a foreigner may use English far more cleverly and wisely than the English do, but though he may live half a century in America, and though he may be a very musical person, yet he will not make his vowel sounds quite correctly. The lesson of this is to teach us how marvelously delicate are the tiny movements of tongue and throat and cheeks and lips which decide the difference between *ham* as we say it, and *ham* as a German, speaking English, says it.

Another of the consequences of the fact that children learn by imitation is that if people, as children, have unfortunately heard the vowel sounds not quite rightly made, it is hard work, and perhaps impossible, for them ever afterwards to get them quite rightly. Now, to make the vowel sounds properly is a mark of having a delicate ear, and of having been surrounded by people who cared about these things, and so, though a man may speak beautifully and be a wicked man, or talk with a "shocking accent," as we say, and be a hero, it is worth while, perhaps, to pay more attention to this matter than many of us do. The number of possible vowel sounds is quite large, for every possible position of the parts of the body concerned in speech will alter, by affecting the over-tones, the sound produced by the vocal cords, and so each of these positions will correspond to a different vowel sound. But, as we know very well, speech consists not only of vowel sounds, but also of consonants, like *b*, *c*, *d*, *f*, *g*, and so on, and of these, also, there is a large number.

THE DIFFERENCE BETWEEN A VOWEL SOUND AND A CONSONANT SOUND

The first thing for us to learn is, what makes the difference between a vowel and a consonant, and there is no doubt at all as to the answer. The difference between a vowel and a consonant is the difference between a musical note and a noise—that is to say, the difference between a series of regular sound-waves and an irregular disturbance of the air. All the vowels are musical notes; to be more accurate, they are blends of many musical notes—the principal one and its over-tones. Now, *i* and *o* are just as much musical notes as *a* or *ah*; but if, instead of saying *ah*, we say *ark*, we are using a consonant, and it takes very little time to prove that we are now making a sound which is not a musical note at all, but a noise. There are many proofs of this.

For instance, the ear tells us the difference in pleasantness between a language full of harsh consonants, such as German, and a "liquid" language, as we say, like Italian, where two consonants of different kinds are scarcely ever allowed to be next to each other, and where the most is made of the vowels. In general, the higher the proportion of vowels to consonants in a language, the more musical we call it.

SOME SOUNDS THAT NOBODY IS ABLE TO SING

Again, we know that it is possible to sing a vowel, and though we may sustain the note for many seconds, we are all the time quite certainly producing the sound of that particular vowel—if we sing properly. But no one can sing a consonant, because every consonant is really an interruption, and nothing else, to the musical tone produced by the larynx. We seem to sing the letter *m*, it is true; but, in fact, when we listen to ourselves, we find that, after the first instant, we are simply singing through our nose a note which is neither *m* nor anything else. The fact of the nature of consonants, as compared with vowels, is very important, both for the singer and the speaker, but in quite different ways, and everyone who speaks or sings knows the difference.

WHY A SINGER LIKES TO SING IN ITALIAN

The first business of the singer is to sing—that is to say, to make music. But the singer is, as a rule, asked to sing words, though sometimes he may be allowed to sing for a little while a mere vowel like *ah;* and words are made up of vowels and consonants—that is, of sounds which are themselves musical, and sounds which are the very opposite of musical; some very unmusical, like *s*, and some less so, like *l*.

Thus, for choice, the singer will use a language, such as Italian, where the proportion of vowels to consonants is high, and when the consonants *do* come in, which, of course, they must if what he says is to be understood, he makes a point of dealing with them very quickly. Let them be definitely uttered, so that the people may hear what is being sung; but let this be done very quickly, because they are noises interrupting the music—every one of them. When we begin to learn to sing, we are all liable to try to sing on the consonants, and the first thing we have to learn is to do the singing on the vowels, which alone can really be sung. It is interesting to note, by the way, that the air-waves made in singing, and even in speaking, will throw scattered powder into patterns, and on page 4092 are some pictures drawn by the human voice.

THE GREAT IMPORTANCE TO A SPEAKER OF PRONOUNCING HIS CONSONANTS WELL

To return to speaking, the first business of a speaker, as contrasted with a singer, is to be understood, and when we come to study the words of any language, we find that the differences between them are due more to consonants than to vowels. The rule for the speaker, therefore, is exactly the opposite of the rule for the singer. Whatever happens, he must make no mistake about his consonants. He must not drop his voice at the ends of sentences or at the ends of words. It may be just at the end of the word that the consonant comes which tells people what the word really is. The fortunate and rare speaker is he who manages to sound his consonants so clearly that he can be understood, and yet is not compelled to sacrifice all the music of his vowels. It is a delight to listen to such a speaker, for he satisfies both needs of his audience—the need of pleasant sound and of understanding without effort.

We do not need to study the consonants very long before we find, either by noticing what happens in ourselves or by looking at other people, that they can be classed. Certain parts of the organs of speech are specially used in making one set of consonants, and other parts in making other sets. For instance, we notice that we make *p*, *b*, and *m* with our lips, and so they are called the *labial* consonants, after the Latin word for lip. The first two we make by a little explosion of the lips, the difference between them being due not to the violence of the explosion, but to the quickness of it.

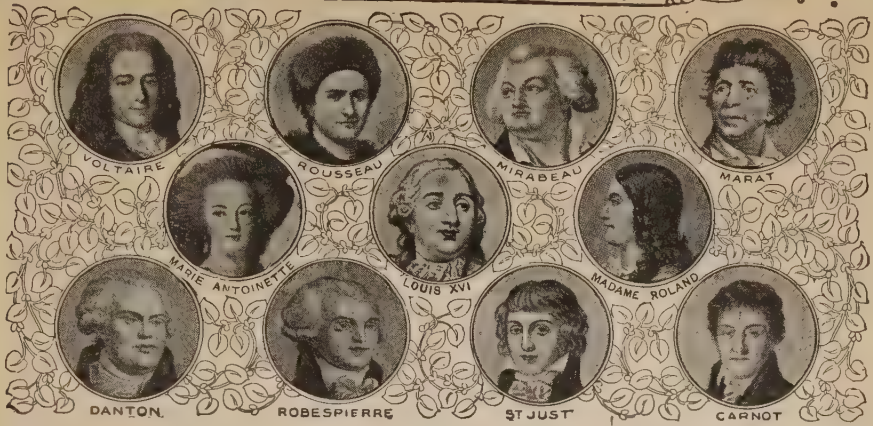
THE USE OF THE TONGUE AND THE TEETH IN PRONOUNCING OUR WORDS

Then we notice that the tongue is mainly used in the making of such vowels as *l* and *r*. There is certainly no doubt about the *r* if we roll it. Then there are certain consonants where there is no doubt that we use the teeth, as, for instance, *d* and *t*, and these are called dentals; and there are others, such as the sound *ng*, in which we evidently use the soft palate—that is, the back part of the roof of the mouth. So we call that a palatal consonant.

The larynx has nothing to do with the consonants, for, as we have seen, its business is to produce musical tones. We have also seen that the quality of sound produced decides the vowel, and that this is decided by the position of the tongue, the lips, and so on. It follows that if we allow air to pass up between the vocal cords, but without using them, we can still produce all the vowels and consonants; in other words, we can whisper, and that is what whispering is.

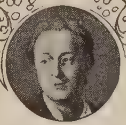
Thus, just as there are defects in speech due to defects in the machine, as, for instance, loss of the teeth, so also there are defects due to what controls the machine, and the chief of these is what we call stammering.

THE NEXT PART OF THIS IS ON PAGE 4259.



THE FRENCH REVOLUTIONISTS

CONTINUED FROM 4038


DIDEROT

LESS than 150 years ago there were very great troubles in the kingdom of France, and violent changes took place. The French monarchy was turned into a republic, so that there was no longer a king at the head of affairs, because it was said that every country ought to be ruled according to the will of the whole people who live in it, and not according to the wishes of one man or of the few who have wealth and power. After all, it was not very long before the French found themselves again being ruled by the will of one man, who became the Emperor Napoleon Bonaparte, of whom we read in other parts of this book.

But the changes which took place before that make up the story of what is called the French Revolution. And some of these changes in the government of the country and the life of the people have continued to the present time in France itself, and some have been adopted since that time into other countries of Europe.

Now we are going to learn something about the men and women who made this French Revolution, or tried to prevent it; but we shall not be able to understand much about them unless we first of all try to imagine that state of things which made people so determined to have a change that they allowed all sorts of wicked and terrible things to be done rather than stay as they were. In England there was a free government—that is, the people ruled through the Parliament, and the king and the ministers had to obey the law like everyone else. But in France the king and his ministers could do very nearly as they liked, so long as they did not interfere with the privileges of the clergy or the nobles.

The common people suffered grievously by reason of these very privileges; for in the country places the peasants were almost the slaves of the great landowners, who were called the seigneurs. And in nearly all the land, except in Brittany and the district called La Vendée, many seigneurs cared little for the needs or the sufferings of the peasants. The seigneurs and the clergy paid few taxes, but the peasants were compelled to pay heavy taxes to the State and feudal dues to the seigneurs, which meant sometimes money and sometimes the produce of their lands. Besides all this, they had to labor for the seigneurs without pay—all of which was very unlike anything that had been known in Great Britain for more than 400 years. There were many people who for a long time past had been saying that all this was very wrong, and had been pointing out that people in England were much more happy and prosperous, and among these we may try to remember the names of Voltaire and Diderot. But these two men did not arouse so much excitement as Jean Jacques Rousseau, who came from Switzerland. He had been brought up in poverty, and had led a strange, wandering, discontented sort of life, failing in everything at which he tried his hand, until he took to expressing his ideas in books, which at once made him famous.

The idea which he held was that civilization was all wrong, and that people would be much happier living in what he called a natural state, with very little law or government at all. He said that people who were strong and rich had persuaded the rest to serve them by pretending that they would protect them, and so had got the power to rule into their own hands, and used it for their own advantage. In this way the poorer classes were robbed of their natural rights.

ROUSSEAU, WHO TAUGHT THAT THE WILL OF THE PEOPLE SHOULD TRIUMPH

He maintained that everybody ought to make a new agreement or social contract, according to which everything should be settled by the will of the people; and that there should be no more kings or seigneurs or people who had privileges, but everything should be arranged in the way that the mass of the people thought best for themselves. This teaching of his about the rights of man and the social contract became very popular.

All the seigneurs belonged to a group of great families who kept themselves aloof from ordinary folk, and they are spoken of sometimes as the *noblesse*, and sometimes as the aristocrats. There were a few of the aristocrats who were very much in favor of some of the new ideas that Diderot or Voltaire or Rousseau was talking about. The king had not nearly enough money to carry on the government, especially as there had been great expense, owing to a war with England, and he was advized that the only thing to be done was to summon an Assembly of the Three Estates—as the Noblesse, the Clergy, and the Commons were called—to consult them as to whether better arrangements could be made for governing the country. At this time there were two men who became very notable as leaders of the people, both of whom belonged to aristocratic families—one was Mirabeau, and the other was Lafayette.

THE TWO MEN WHO MIGHT HAVE SAVED FRANCE FROM THE GREAT TERROR

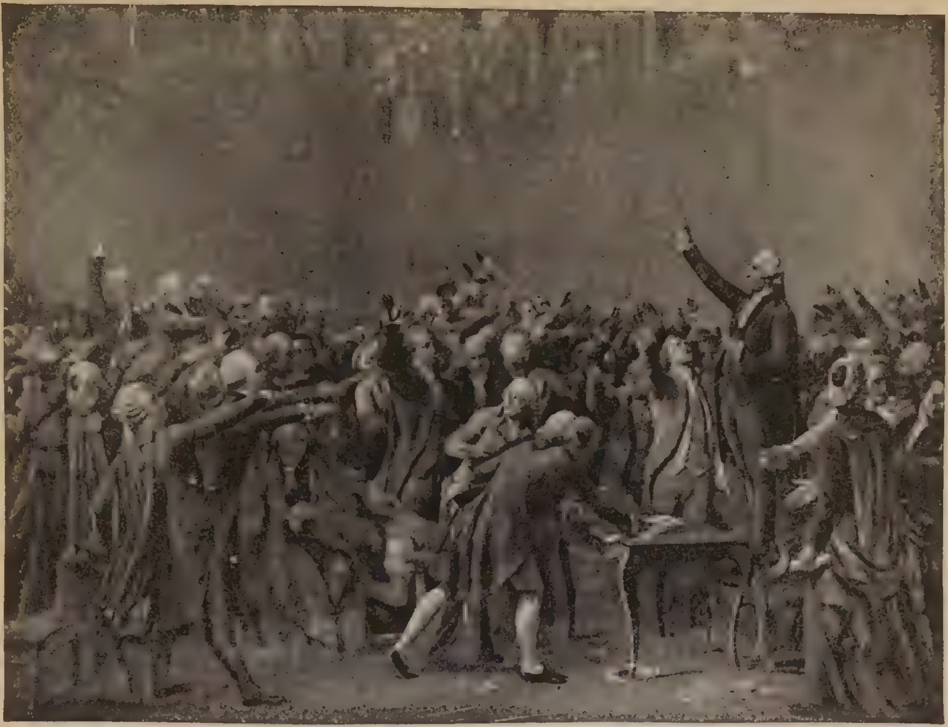
It was a very unfortunate thing that these two could not be friends, for what both of them wanted was to set up in France a government in which the voice of the people should be heard, and yet let the king and his ministers have a good deal of power—more, really, than the King of England had. Both of them had learned a good deal in England or in America; for Lafayette had come to America when he was only twenty, and had served under the great George Washington in the war which ended in the separation of the United States from England; so he had seen what Americans and Englishmen meant by freedom, and also how wise and great a man Washington was.

Mirabeau had lived for some time in England, and had seen there how it was possible for justice and law to rule everywhere without any oppression, and for both king and people to have a share in the government. But the least that either of them wanted would have made so great a change in France that the court and most of the aristocrats and the clergy would have nothing to say to them. And perhaps the saddest thing is that if King Louis had been a wiser man, those three working together might have made the French Revolution a peaceful affair, which would have set up in France a government not very unlike that of England.

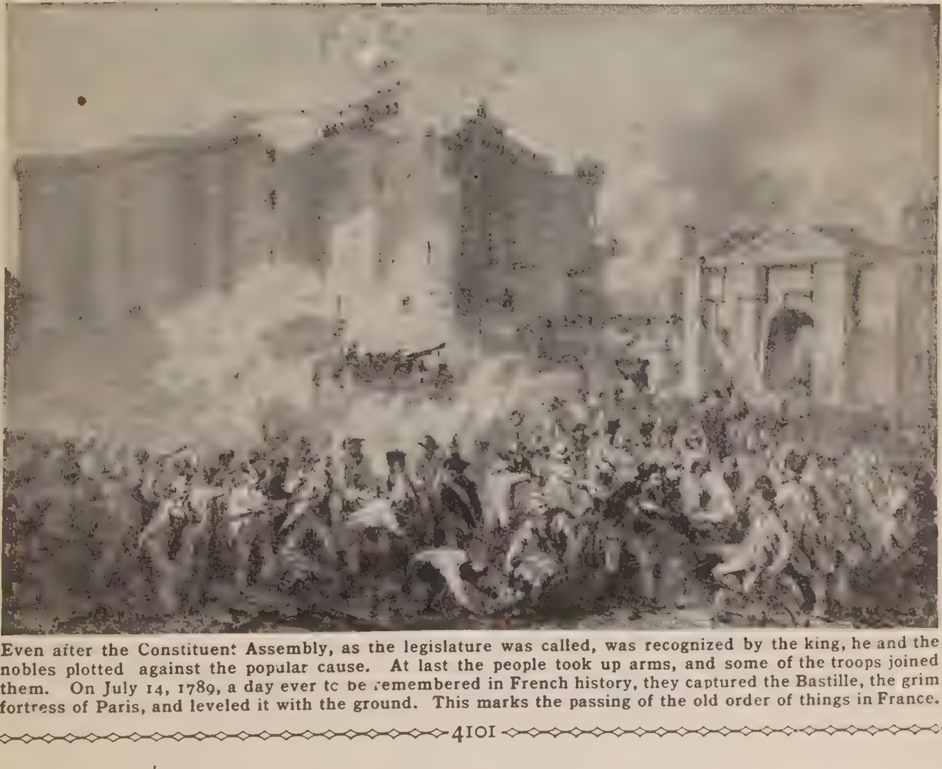
THE GOOD KING LOUIS, WHO TRUSTED BAD COUNSELORS

Louis himself was a good man, who wished to do what was right and just. He was a brave man, too. But he was not clever himself, and he was not like some other kings who have had the wit to choose good advizers and trust them. Instead of that, he trusted people who gave him bad advice, and could see nothing but harm in the changes that Mirabeau and Lafayette demanded when the Three Estates were assembled in what was called the States-General and

THE BIRTH OF THE FRENCH REVOLUTION



At the outset of the French Revolution, the hall in which the Third Estate met was closed to prepare it for a session which the king was to attend. The representatives of the Third Estate went to the Tennis Court and took an oath that they would never separate until the constitution of the kingdom was established.



Even after the Constituent Assembly, as the legislature was called, was recognized by the king, he and the nobles plotted against the popular cause. At last the people took up arms, and some of the troops joined them. On July 14, 1789, a day ever to be remembered in French history, they captured the Bastille, the grim fortress of Paris, and leveled it with the ground. This marks the passing of the old order of things in France.

afterwards the National Assembly. It seemed to them that to take away the privileges of the noblesse and of the clergy would be robbery, and that the proper thing for the common people was not to govern but to obey their betters, among whom was Queen Marie Antoinette.

Mirabeau understood what was needed better than any other man in France. He was a man who lived a wild life privately, and was always greatly in debt, which set a good many people very much against him; and he was so domineering that it was not easy to be friendly with him. But he was a wonderful orator; so that when the Assembly had come together bent on doing one thing, he could sometimes persuade it to agree to something altogether different. He would rouse people up to be enthusiastic when they were timid and hesitating; and in this way he had a great deal of power, though people were really afraid to trust him.

He was called the Tribune of the People, because he was so bold in demanding what he considered the people ought to have, and because he wanted the "privileged orders" to have their privileges taken away and to pay their share of the taxes.

HOW MIRABEAU TRIED TO BRING THE KING AND THE PEOPLE TOGETHER

But he saw, too, that many who had come to the Assembly had no idea of what good government meant. He felt that the Assembly was not yet fit to rule. He wanted it to have power, but he believed that the only way to prevent terrible things happening was for him to become the real ruler himself. He wanted the people to trust him, and he wanted the king to trust him; but presently it came about that, while the king suspected him of being on the side of the people and against the crown, the people, and those who had most influence with them, suspected him of being really on the side of the crown against the people, when the thing he was striving to do was to unite crown and people for the good of both.

Several of the changes which Mirabeau wanted were made, but there was really no chance of bringing the king and the people into agreement after he died, which happened before the troubles had been going on for a very long time; for he tried to do such an immense amount of work that he wore himself out, and as soon as he fell ill, death overtook him very quickly.

Lafayette was a very different kind of person. He was a very popular and high-minded gentleman, who had won great praise as a soldier when he was fighting in America under George Washington. After the States-General had come together, and had been turned into the National Assembly, it began to be very difficult to keep order, because everyone was in a state of excitement.

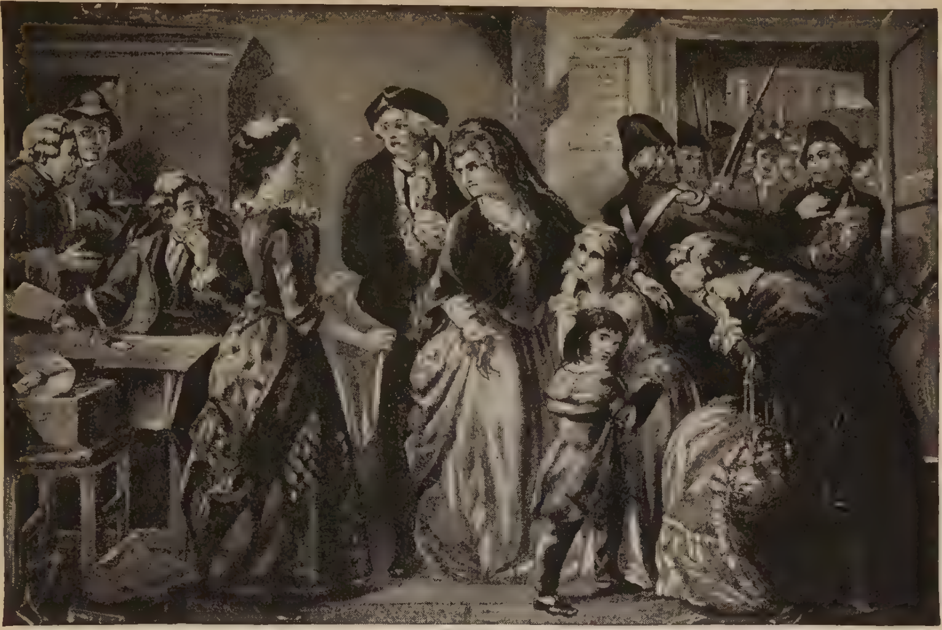
LAFAYETTE, WHO TRIED TO KEEP ORDER IN PARIS AND DISPLEASED ALL PARTIES

So the better class of the citizens in Paris were enrolled, as soldiers in what was called the National Guard, to keep order; and Lafayette was made their general. He was very popular among them, and some people began to think that Lafayette meant to make himself the real master by the help of his soldiers, like Julius Cæsar in Rome or Oliver Cromwell in England. Besides, it was not very easy for the ordinary people to believe that so fine a gentleman as Lafayette cared much about them; and the noblesse hated him because they thought he had deserted their order; and the queen and court disliked him because they thought he was trying to become dictator. At last, when there was a great riot, and Lafayette had to order his soldiers to attack the mob, the common folk liked him less than ever, and he found that even his soldiers were only half inclined to obey him. He always wanted to check violence; but he could not sway men as Mirabeau could sway even those who did not trust him. So when more violent men got the upper hand, Lafayette no longer commanded the National Guard. Later on, when France declared war against Austria and Prussia, he was sent to command the French army; but Paris became so disturbed that he wanted to take the French troops back there, and when he found that he could not do so, he would not remain in command, but left the country.

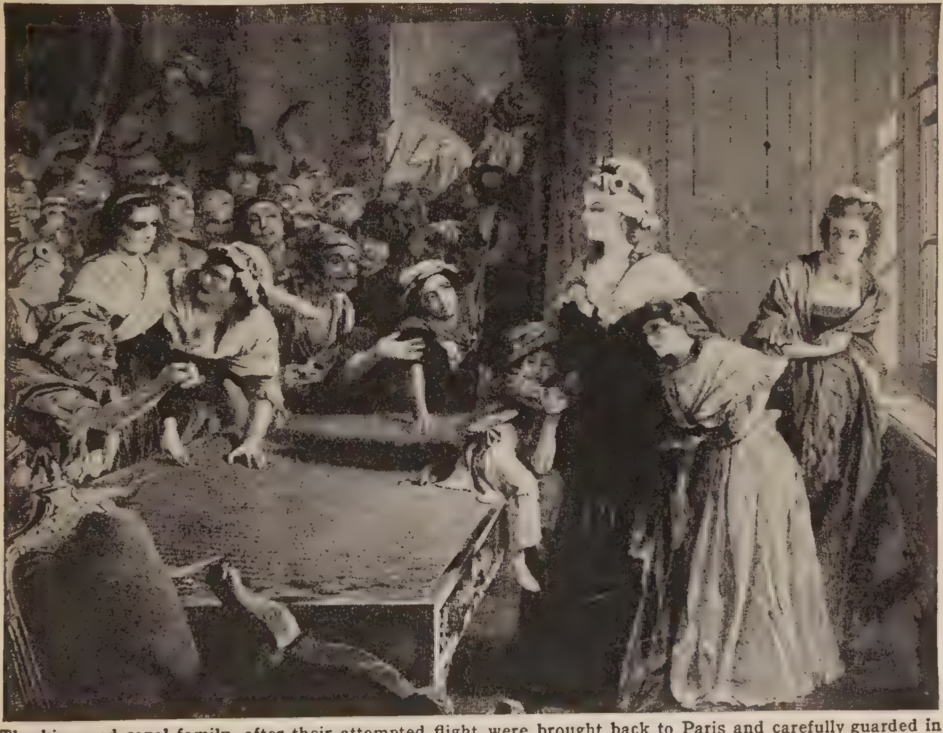
HOW LAFAYETTE HELPED TO BRING BACK A KING TO FRANCE

As for what befell him afterwards, he was made prisoner by the Austrians, and after spending some years in prison he was set free. Later, he helped in the restoration of the Bourbon king;

THE ROYAL FAMILY CAPTURED BY THE MOB

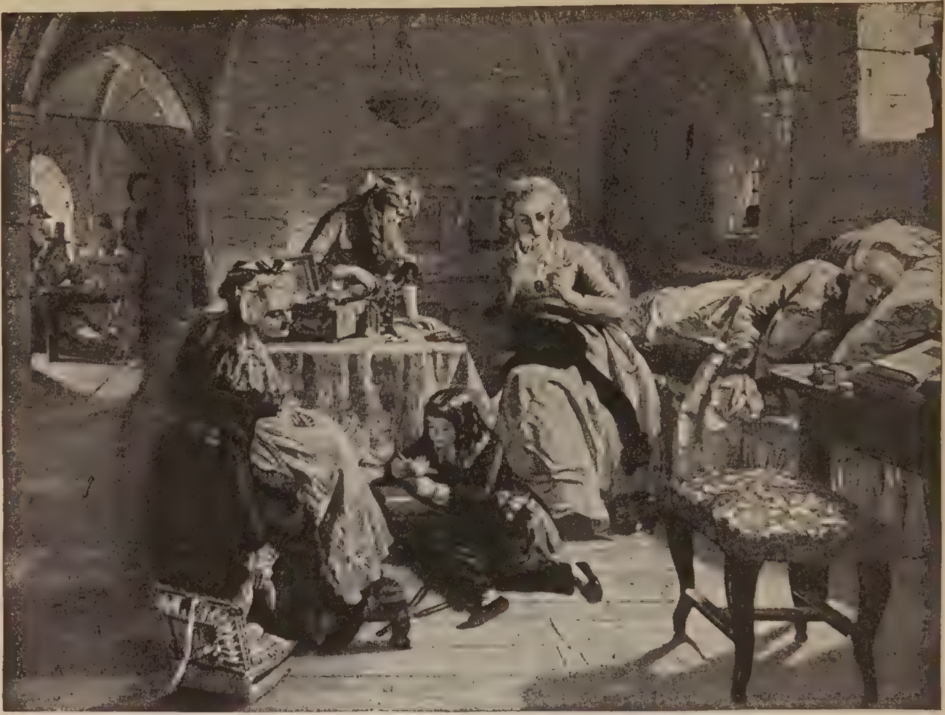


With the fall of the Bastille the power of the French king was gone, for the destruction of that relic of tyranny showed the people their strength. Louis XVI. was brought from Versailles to Paris by the mob, and was little better than a prisoner in his palace. At last he determined to escape with his family from Paris, but when the royal fugitives reached Varennes they were recognized and stopped, as shown in this picture.

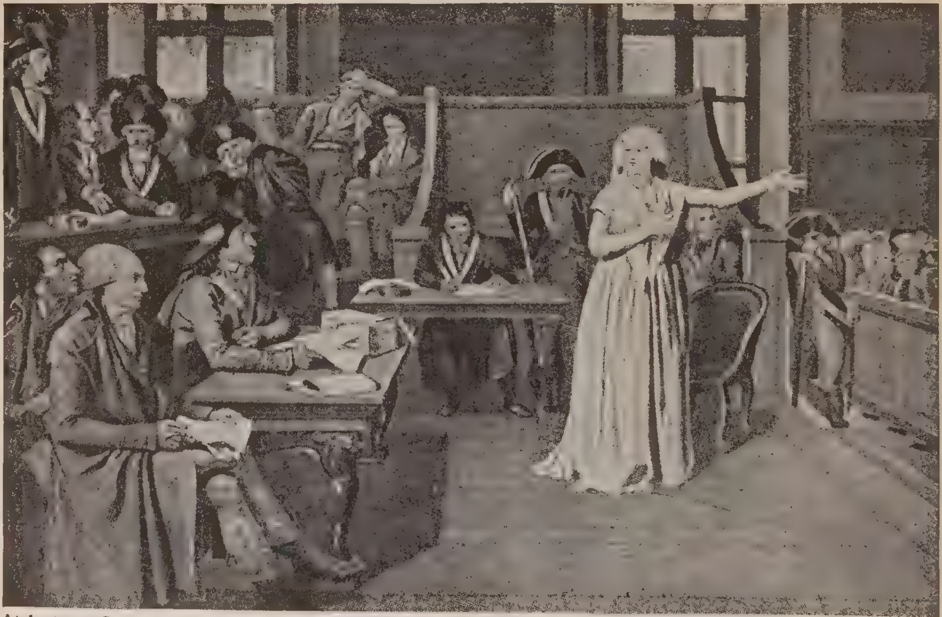


The king and royal family, after their attempted flight, were brought back to Paris and carefully guarded in the Tuileries. Led by demagogues, the mob gradually became violent, and on June 20, 1792, the anniversary of the oath in the tennis-court, forty thousand people marched to the Tuileries, burst into the palace, and insulted the royal family, as shown here. The queen is standing with her children behind a table. This picture is from the painting by the well-known artist Alfred Elmore, R.A., by permission of the Art Union.

THE LAST DAYS OF THE KING AND QUEEN

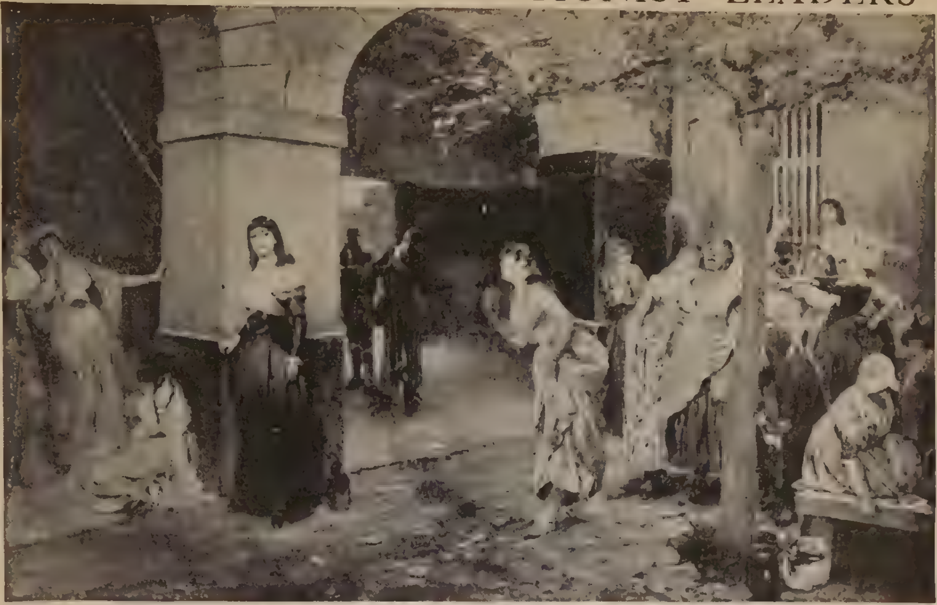


Encouraged by their growing power, and exasperated by the foolish threats of the nobles and princes who had escaped from France, the leaders of the people decided to remove the royal family to the close confinement of the prison of the Temple, and to destroy all aristocrats. In two or three days over a thousand prisoners were massacred, and no one knew how long he or she would be safe from the dreaded guillotine.

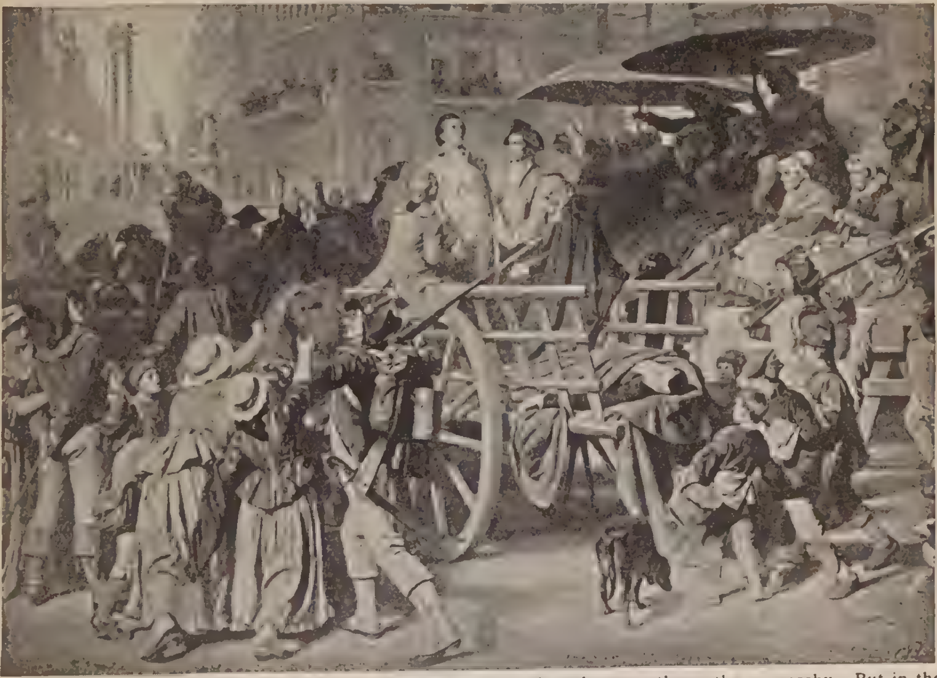


At last, on September 21, 1792, the monarchy was abolished in France, and a republic proclaimed. Shortly afterwards the king was separated from his family, brought to trial, and beheaded. The Reign of Terror was now in full force, and, in the following year, Queen Marie Antoinette was also tried and condemned to death, as shown here. Whatever may have been her early follies, at her trial she acted in every way like a queen.

FALL OF THE REVOLUTIONIST LEADERS



In the French Revolution, so soon as one set of men obtained power they were destroyed by another set more extreme. The most bloodthirsty party was that of the Jacobins, who destroyed the Girondins. One of these Girondins was Madame Roland, a beautiful and clever woman, who did much to direct the Revolution. But she was imprisoned by the Jacobins in the prison of Saint Pelagie, as shown here, and then beheaded. On the scaffold she exclaimed: "O Liberty, what crimes are committed in thy name!"



The Girondins had been allied with the Jacobins, and together they overthrew the monarchy. But in the massacres of prisoners by the Jacobins the Girondins had no part, and, indeed, they tried to prevent the bloodshed. When the Jacobins, who were cruel and bloodthirsty, felt themselves sufficiently powerful, they sent the Girondins to the scaffold in large numbers, as shown in this picture. The mob in Paris enjoyed seeing the victims go to execution, and mocked them as they went through the streets to the scaffold.

The picture of Madame Roland at St. Pelagie is by Edouard Carpentier, and the lower picture is from a painting by the French artist Piloty.

and, at the end of his long life, he helped in another little revolution when Charles X. was put off the throne and his cousin, Louis Philippe, was made king in his place.

Now let us look at the king and queen, whose story is so tragical. Louis always meant well, and would have been quite willing to grant much more power to the people, and to put an end to bad laws and customs; but the people round him were always persuading him that if he allowed one thing or another to be done, the king would never again have any power; and Louis thought that a king had no right to give up his power. So he could never make up his mind either to trust Mirabeau or any other of the leaders of the people, or, on the other hand, to take up his stand boldly as a monarch who was determined that his own will should be obeyed. In one way he was a brave man, for he had no fear of death, but he had not the other kind of courage which enables a man to resolve on a plan of action in which there are risks, and to carry it through in spite of dangers and difficulties.

HOW THE KING AND QUEEN TRIED TO ESCAPE FROM FRANCE IN THE DARK

Soon after the death of Mirabeau, the king and queen thought the best thing they could do was to take flight out of France, and then perhaps other kings would help them to recover their power, for the queen was the sister of the Emperor of Austria.

They made preparations secretly, and fled by night from Paris in a carriage, pretending to be just a gentleman and his wife. But at a place near the frontier, the king was recognized when he got out of his carriage, and they were stopped and sent back to Paris, where they were kept prisoners. Louis accepted the new constitution, or rules for governing the country, which the Assembly had prepared, and so he was still king. A new Assembly was called, but the king had no able men about him now whom he could make ministers, and the cleverest men whom he tried would not do as he wished, or serve him if he did not do as they wished. At this time, because the Austrian Emperor and the King of Prussia threatened to interfere, Louis was forced to declare war against them. And at the same time the men who were called Jacobins, which was the name of a club or association to which they belonged, were stirring up feeling against the monarchy, and Paris was becoming very much excited.

A MOB THAT BROKE INTO A PALACE AND MADE THE KING WEAR A RED CAP

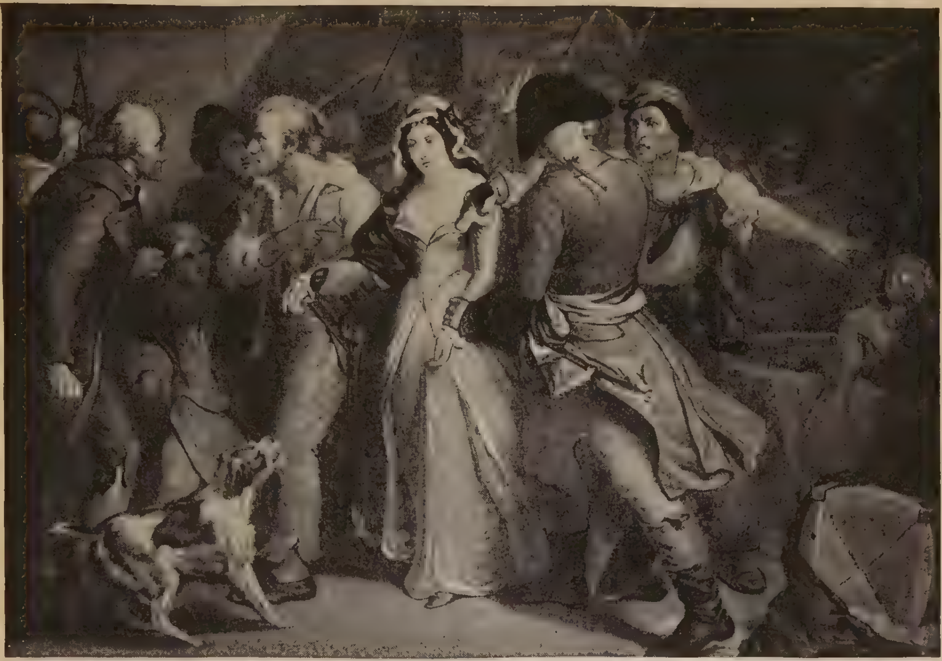
One day there was a great procession, which found its way into the royal palace of the Tuileries; and the King of France was obliged to set on his head the red cap of liberty. The queen, too, had to set one on the head of the little Prince Royal, the heir to the throne. No real harm was done that time; but when ill news came from the war, and the Prussians made a proclamation that Paris would be punished if the king were hurt, the people became furious. The royal palace was attacked by a mob thirsting for blood; the valiant Swiss Guards, who defended it stoutly, were cut to pieces. But the king and queen had fled with the rest of the royal family, and taken refuge with the Assembly. Then, later, there came another new Assembly, which was full of Jacobins, and of others who wanted a republic, who were called Girondins; and the new Assembly proclaimed that France was now a republic and the king and queen were merely citizens. And even before this the Jacobins had put to death a number of royalists, or supporters of the king, who had been thrown into prison, in what were called the September massacres. The next thing was to bring the king himself to trial, as Charles I. had been tried in England just 140 years before. He was tried by the Assembly itself, and condemned to death.

A ROYAL PRINCE WHO VOTED FOR THE KING'S DEATH

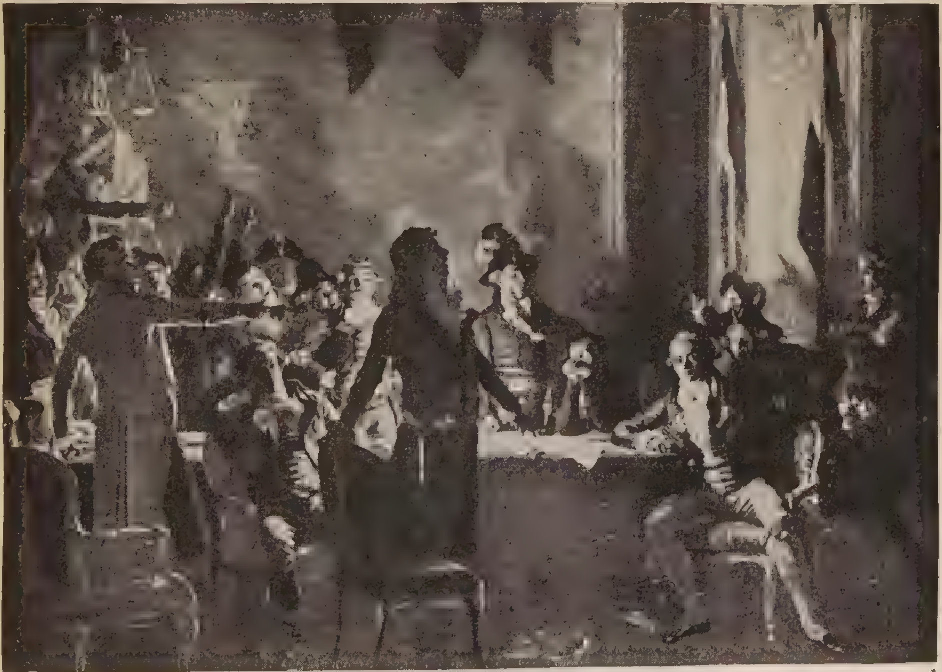
Like Charles the First, Louis showed a royal dignity and fortitude. He was beheaded, not with an axe like Charles, but by an instrument called the *guillotine*, which had been brought into regular use in France by this time. King Louis's own cousin, Prince Philip of Orleans, was one of those who voted for his death.

The poor queen and her children remained prisoners for a long time. Marie Antoinette greatly deserves to be pitied, for though she had not always been wise, yet, when misfortune came upon her, she behaved with splendid courage; and it has always been counted among the wickedest deeds of the Jacobins that she,

THE END OF THE LEADERS OF THE TERROR



The most ferocious villain in the Reign of Terror was Marat, one of those monsters whom Nature rarely produces. Even his bloodthirsty associates shunned him, and his very appearance struck terror. A beautiful young woman named Charlotte Corday, whose lover Marat had caused to be assassinated at Caen, determined to rid her country of such a ruffian. Going to Paris, she went to Marat's house and stabbed him.



Less ferocious, though not less thirsty for blood, Robespierre was for a time the leader of the Terror, and day after day victims went to the guillotine, until at last his associates and the people became tired of so many executions. Robespierre was denounced, arrested, and suffered on the guillotine to which he had sent so many others. With his death the Reign of Terror ceased, and gradually peace and safety returned.

Photographed by permission of Messrs. Braun Clement and Company.

too, was sent to the guillotine by them, nearly a year after her husband.

She was not yet forty years old when she was slain; but the long, terrible months of anxiety had changed her so, that she seemed almost an old woman. When she became Queen of France, she was a beautiful and attractive girl who had never known what it was to have her will crossed, and had been taught to take it for granted that kings and queens have a right to go their own way, so that she always encouraged the king to resist. When she died, she died like a queen.

One woman is famous who was on the side of the Revolution. The party who wanted a republic in France was divided into two sections called the Girondins and the Jacobins; and of these the Jacobins were much the fiercer. For the desire of the Girondins was to have a republic like that of ancient Rome; they did not wish to destroy for the pleasure of destroying.

THE NOBLE MADAME ROLAND, WHO DIED BECAUSE SHE TRIED TO SAVE OTHERS

Among the Girondins, Madame Roland had great influence, and was accounted a woman both noble and wise. But after the king had been slain, the Jacobins got the upper hand altogether, and turned upon the Girondins, who wished to check bloodshed. Many of them were flung into prison, among whom was Madame Roland; and many were sent to the guillotine, though they had striven their hardest for liberty. And so it was that Madame Roland died in the same way as Marie Antoinette.

We have not much space left for talking about the men who wrought the worst evils in the Revolution. There are three who are commonly named together, and of these one came very near to being a great man. This was Danton—terrible, fearless, ruthless. It was he who caused the September massacres, because he thought that was the only way to make sure that there would not be a rising of the royalists, just at the moment when it seemed that foreign armies might be marching on Paris. And it was he who spoke these fierce words, when the kings of Europe seemed to be gathering their forces to crush the French Republic: "To the kings, we will fling down the head of a king as the gage of battle"—meaning that Louis should be beheaded. After that he would have joined hands with the Girondins in checking bloodshed, but they would not join him; so he held by the Jacobins, yet still strove to stay their bloodthirstiness, desiring only to slay when he thought it needful to make opponents afraid. And again the more cruel among them got the upper hand, and Danton, in his turn, was sent to the guillotine.

HOW A YOUNG GIRL RID FRANCE OF A BLOODTHIRSTY TYRANT

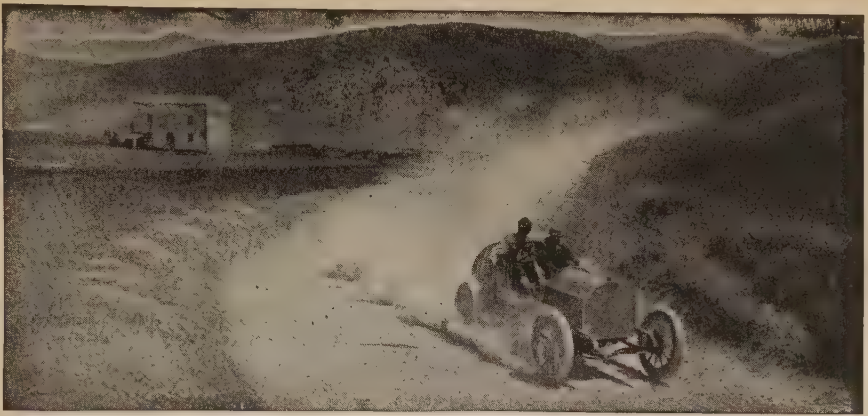
The second of the three was Marat, who called himself the "friend of the people," foul of speech, craving for blood, ever urging death for the aristocrats. He did not die by the guillotine, for his wickedness so stirred the heart of a girl named Charlotte Corday that she thought it was her mission to free the world from such a monster. So she came to Paris, and, being admitted to speak with him, drew a dagger and slew him; for which deed she, too, gave up her life under the guillotine.

The third was for a time the most powerful of them all. This was Maximilian Robespierre, a little, unhealthy-looking man, who would have been simply a very respectable citizen if he had remained in private life. But he had one idea in his head which he was quite determined to carry out. This was that the will of what he called the "Sovereign People" must rule, and the way to bring that about was to destroy everything that could possibly stand in the way—kings or aristocrats, Girondins or Jacobins, men or women, young or old. He got all the power in his own hands, till at last, week after week, the guillotine was killing fifty people every day.

THE END OF THE TERROR AND THE DEATH OF ROBESPIERRE

Then even his own supporters grew weary and disgusted, and turned upon him; and he, too, went to the guillotine. When his head fell, those who stood by shouted for joy. With his death, the Reign of Terror came to an end, and the ruling of the French Republic passed into the hands of a group of people called the Directory. How in after time Napoleon Bonaparte first served the Republic, and then overthrew it and made himself emperor, we read on another page.

THE NEXT MEN AND WOMEN BEGIN ON 4155.



WHERE DOES DUST COME FROM?

CONTINUED FROM 4024

DUST is matter that has been ground or worn down into tiny separate pieces, like the sand in the desert, of which some pictures are shown on 4118 and other pages. If there is much water about, it catches the dust and makes it into mud; and then, when the mud dries, it is blown into dust again. There can be no dust at all on the moon; nothing is worn down into dust there. The forces that make dust on the earth are air, especially moving air that we call wind, and water. These are, perhaps, helped a little by the power of light. Of course, different kinds of things differ in the ease with which wind and rain can grind them down into dust, and so we find less dust in some places than others, even though both are equally exposed to wind and rain.

In places where men's feet or wheels of carts and carriages are traveling over and rubbing the ground, much dust is also made by them. That is one reason why cities are so dusty in dry weather. Water-carts lay the dust, because water is heavy, and when a speck of dust is soaked in water, it can scarcely be blown about in the air. In cities, also, much dust is made in the roads by horses, and it is probable that this is very bad for people's throats and eyes. But the most dangerous dust of all is the dust made by the spitting of consumptive people, and this really is one of the principal ways in which tuberculosis is spread. Many people have worked hard for a law to prevent people making this deadly dust. Now in most cities there is a law against spitting in trains and street-cars and other public places.

DO WE GROW JUST AS MUCH ONE YEAR AS ANOTHER?

Certainly we do not. For one thing, whenever we have an illness our growth is affected—usually it is lessened; but sometimes it may be increased, and that makes a difference to our growth in that year. But even if we have no illness, and live exactly even lives from year to year, our rate of growth varies very much.

Both boys and girls, but especially boys, grow much more in the years from about fourteen to seventeen than they do at other times. Growth in height depends almost entirely on the lengthening of the bones of the legs; and it is the differences in the length of the legs that makes the difference in people's heights. That is why we cannot tell how much people differ in height when they are all sitting down. The bones of the legs grow in length by the making of new bone at certain places near their ends. After about the age of eighteen most of these places stop working, and only those which are left can add to our height. Some do not grow much after eighteen. A few years later the rest of these places stop working, and the whole length of the bone becomes finally fixed. Some grow much more slowly after the age of seventeen or eighteen.

WHY DOES A LIGHT GO OUT IN WATER BUT FLARE UP IN KEROSENE?

Water is burned, or oxidized, hydrogen. Being already burned, it can be burned no more. When a light is dipped in water, it is deprived of the oxygen by which it is burning, just as a drowning man would be. There is a little oxygen dissolved in water, enough for fishes to burn or breathe by; but this is not enough to support a light. Perhaps it might be, but that water is a very quick and good conductor of heat. So when a burning thing, or a hot glowing thing, like a red-hot wire that is not burning, is plunged into water, it very rapidly loses a lot of heat to the water, and so it is lowered to a temperature at which it cannot burn, or glow, as the case may be.

But kerosene is a compound of carbon and hydrogen, each of which is very ready to combine with oxygen—that is, to burn—when it is made hot enough. A light put into it does this, and so the light flares up, because the kerosene begins to burn. The products of its burning are water, H_2O, and carbon dioxide, CO_2; and when the paraffin has been changed into these two substances, it can be burned no more.

HOW MANY WORLDS ARE THERE?

This question could only be answered if we knew that we could see, or somehow knew without seeing, all the worlds there are. But all we can see, or otherwise discover, are doubtless nothing to the whole number of worlds. By means of photographing the light that comes through telescopes, we can discover not less than one hundred millions of bright worlds in the sky. If we had larger telescopes or more sensitive photographic plates, we should discover more, and every year we do discover more worlds. Still, one hundred millions of bright stars is an easy figure to remember.

Then we can prove the existence of a large number of stars which have "gone out," and are now dark and cold. But it is only a very tiny proportion of the dark stars of which we can *prove* the existence by their effects on the movements of the bright stars, and, so far as we can judge, the bright part of a star's history must be very short compared with the dark part. So we should require to add probably thousands of millions of dark stars to correspond to the bright stars that we know. Then our own sun has many large planets and moons circling round it, and hundreds of very tiny planets. If other stars have the same number, on the average, round them, we see that the huge number of worlds grows greater still.

WHERE DOES OUR WARMTH COME FROM?

Our warmth is all the result of the burning that goes on ceaselessly within our bodies. We do not realize how much this burning is, for we do not realize how much heat we are always losing from our bodies. If we lost no heat from our bodies, they would become as hot as boiling water in a very few hours. All this heat is made by the burning of our food. It burns, as other things burn, by combining with oxygen, and that is brought into the body by our breathing. The chief part of the burning that produces our heat occurs in our muscles and in a large gland, the largest in the body, called the liver.

We may think of the muscles as the fireplaces of the body, and the fuel burned there is mostly fat and sugar. A great deal of heat is produced when a muscle contracts, and that is why hard exercise makes us so hot; but, even when the muscles are still, this burning and making of heat are always going on. The liver, too, is always active, and we know that the blood leaving the liver is considerably hotter than the blood going to it.

Though all parts of the body do not produce equal warmth, they are all kept at just about the same temperature by the circulation of the blood—which takes heat from the hottest places, such as the liver, and gives it to the coldest places, such as the fingers and toes.

WHAT DID THE FIRST LIVING THING IN THE WORLD EAT?

This is one of the most important of all the questions that have to do with the beginning of life on our planet. When we study the food of animals, we find that they all, without exception, depend for their food upon the work done by other living creatures—either plants or other animals that live on plants. Therefore we are quite sure that the first living creatures on the earth cannot have been animals. Even if animals had been brought to the earth from some other world, there would have been nothing for them to eat, and they must have died of starvation.

Now, when we study the food of plants, we find a great difference. They can live entirely on things which have been made, or can be made, in the air and in the soil, without the action of life of any kind. Hence we know that plants must have lived before animals on the earth, and that the first living creatures must have been plant-like.

We say *plant-like*, rather than *plants*, because they were, perhaps, very different from any plants that exist on the earth to-day—perhaps simpler than the simplest living cell we can find anywhere. And, like most plants of to-day, they must have lived upon water, the carbon dioxide of the air, and the various salts, not needing to be made by the action of life, that are found in the soil. Important above all must have been the salts containing nitrogen, washed down into the soil by the rain from the air when they began to be made through the action of electricity in the oxygen and nitrogen of the atmosphere.

IF RADIUM COULD BE TAKEN TO THE NORTH POLE WOULD IT CHANGE THE CLIMATE?

In answer to this question we must be allowed to ask: How much radium? Of course, it all depends on that. A little radium produces only a little heat, though a very great deal in proportion to its quantity; while a lot of radium produces a lot of heat. If we could take a quantity of radium to the North Pole, beyond any doubt it would alter the climate there for thousands of years. If enough were taken it would make a tropical climate everywhere.

The time may quite well come when men may change the climate of the colder parts of the earth in some such way as is suggested—perhaps for the first time—in this question; and in the days to come men will need to make every part of the world habitable that they can, for the number of human beings in the world is always increasing. But if all the radium that has been separated from the things among which it is found were gathered into one room, no one would notice any difference in the temperature of the room, so small is the amount of radium that the chemists have yet extracted. It will certainly be a long time yet before there is enough radium collected to weigh a pound, and then that pound will be worth an enormous sum of money, for it will have cost years of labor to collect. But the time may come when we shall learn how to make radium from other elements quite easily, and then the sort of thing that is suggested in the question will be quite possible.

WHY IS GOLD NOT FOUND IN ENGLAND?

This is really a special way of asking a general question. Why do we find the various elements where we do, and not elsewhere? We are only just beginning to get the knowledge which will perhaps some day enable us to answer this question. Until quite lately, most people thought that the elements, such as gold, had always existed as they are now, and so there was no use in asking the question: Where did they come from?

If we thought this, we could never hope to say why gold is found in certain parts of the world and not in others. But now we are beginning to learn that the elements have a history. In a few years we may learn how gold came into existence—from what other element or elements it was formed; and so in time we may hope to learn how to explain the present distribution of gold and the other elements in the earth's crust.

We must always remember that gold, like most elements, is much more widely distributed than most people suppose. We usually only hear about the presence of a precious element anywhere when there is enough of it to pay for getting it out. But gold occurs in traces almost everywhere, just as the far rarer element, radium, does. It is found in sea water everywhere, and even in some kinds of earth in parts of England; but there is not enough to be found to pay for the trouble of getting it out.

IS THERE ANY OF THE HISTORY OF ENGLAND UNDISCOVERED?

Certainly there is. Of course, we do not mean its recent history, for that goes back only about two thousand years, and it must be many thousands of years since England was broken off from the Continent of Europe by the English Channel. There are only Stonehenge and one or two more such places to help us with the history of England as it was long ago, and Stonehenge tells us that a very clever race of people, who knew a lot about the skies and who could raise huge stones, lived in England 1,600 years before the birth of Christ; and that is all we know about them. We do not know what became of them, and we do not know where they came from—whether they sailed across the sea, or whether their ancestors were already in England when England became an island.

Plainly, we cannot say that all the history of England is discovered when we do not even know how the first men got into it. The part of the island's history that we know is only like the history of yesterday compared with the vast part that must now be lost for ever.

WHY CAN WE OFTEN SEE THE WHOLE CIRCLE OF THE MOON WHEN IT IS NOT SHINING?

The reason is that the earth shines brightly by the sun's light, just as the moon does; and the earth's light is enough to light up the moon, so that we can sometimes see even the part of its face that is not lit by the sun.

There is a very curious and celebrated mistake in a famous English poem, which shows that the poet did not at all understand the moon, and apparently had never seen what we have seen. It is "The Ancient Mariner," by Coleridge. He speaks of

> The hornèd moon, with one bright star
> Within the nether tip.

Of course, no one ever saw a star within either tip of the crescent moon, because the rest of the moon is there, and would hide the star. The nearest star is, of course, many millions of miles farther away than the moon. If Coleridge had ever seen the moon as described in this question, he could not have made such an extraordinary mistake.

WHY CAN WE NOT SEND A LETTER WITHOUT A POSTAGE STAMP ON IT?

Well, there is no reason why we should not send all our letters without stamps on them, provided that we could find some hundreds of thousands of people to do the work of postmen and sorters and post-office officials, and railway servants, and that we could get other people to make and maintain railways and engines, and to dig coal to drive engines—and a few other things like that—all without payment. We write a letter and drop it in a letter-box, and it reaches our friends a hundred miles away, or perhaps in Australia, and we think no more about it. But an enormous amount of human labor is required. If we think of sending a letter to England, which we can now do for 2 cents, we must include all the work of the men who make the ships and the compasses, the sailors who work them, and the people who make the harbors. If these things did not exist, it would cost thousands of dollars to send a letter across the world; and railways cost so much to make that it would cost thousands to send a letter quickly across the continent.

But as millions of people have letters to send, and as we can always count on their continuing to want to send letters, preparations can be made, and then their millions and millions of pennies, put together, will pay for everything, and enable each of them to send a letter thousands of miles for 2 cents. So the question we should have asked is not, Why can we not send a letter without a postage stamp on it? but, Why does it not cost ten thousand dollars to send a letter?

CAN ANYTHING TRAVEL FASTER THAN THOUGHT?

We sometimes say "as quick as thought," as if thought were the quickest thing in the world; but that is very far from true. When we think, waves of something—we can only call them nerve-currents—travel along the nerves inside our brains. So if we want to measure the speed of thought, the best way to do so is to measure the rate at which a nerve-current travels along a nerve.

This cannot possibly be done directly in anyone's brain; but we can do it in other ways. We can take a long nerve, such as we find in the arm or the leg, and by the use of delicate electrical clocks we can find how fast it carries its messages. About the speed of an express train is what we find. That is very slow compared with the speed of the earth, and slowness itself compared with the speed of light. So "as quick as lightning" means far more—*millions* of times more—than "as quick as thought."

Now we can do another thing. We can find out how long a person takes to distinguish between, say, a red color and a black color. When he sees red he is to do a certain thing, and when he sees blue he is to do something else—as quickly as he can. We can measure exactly how many hundredths of a second this takes to do; then we can subtract the time taken in running to and from the brain, and we find that most of the time was spent in the brain—spent in the thinking. So we must conclude that thought is not really a speedy thing at all; but we must remember that speed is not everything.

WHY DOES A HEN NOT CROW?

When we study birds, we find it a general rule that the male birds are the most brightly colored, and it is the male birds that sing. The feathers of the female birds are usually less bright, and their voices are not so melodious. It is probable that both the bright coloring of so many male birds—compare the peacock with the peahen—and their singing are things that have been evolved to make them prominent and pleasing in the eyes of the females. Among animals it is usually the females that choose the males they like best, which are usually the finest specimens of their kind; and it would certainly be better for the progress of human beings if that were more the rule among ourselves also.

We may say that the crowing of a cock is not to be called singing, and certainly it is a very ugly noise compared with the singing of the lark, or the thrush, or the nightingale; but still it is really the cock's way of singing, and probably it gives pleasure to the hens. Even among ourselves the notion of what is nice singing varies very much with different people, and the hen has as good a right to her opinion of the cock's singing as we have.

WHY DOES A NEWSPAPER STRETCHED ACROSS A GRATE MAKE THE FIRE BURN UP?

The effect of the newspaper is really the same as the effect of blowing the fire with a pair of bellows. All burning depends on the supply of air. The more quickly fresh air—that is, the oxygen in the air—is supplied, and the more quickly the gases produced by the burning are blown away from the fuel, the more brightly will the fire burn. The fire makes a draught for itself up to a point, for the gases it produces are hot, and so rise, while fresh air comes in to fill the space they tend to leave empty. If we want a very hot and quick fire we make a forced draught, as we do when we use a pair of bellows. The newspaper greatly increases the draught of air through the fire, by preventing any air from getting up the chimney except by first passing right through the fire from below the grate.

The air usually travels up the chimney when a fire is lit at the rate of about three feet in each second. That is why a fire helps to ventilate a room. But much of this air gets into the chimney above the fire and does not help it to burn at all. When we use a newspaper we stop this; and the air has to pass quickly right through the grate. It is one of the stupid things about an ordinary fire, accounting for most of the smoke it makes, that we pile the fresh fuel on the top, where much of it is blown up the chimney unburned, by the burned gases of the fire, instead of adding it at the bottom, where the fresh air can act on it.

WHY IS IT THAT PURE OXYGEN WILL KILL US?

This question rather reminds us of the lawyer's question: "Have you left off beating your wife?" No matter whether the man answers "Yes" or "No," he is in a difficulty. A question like this is what students of language call a double question, and we must always be on the look-out for such questions. The lawyer assumed the answer "Yes" to another question: "Have you ever beaten your wife?" And here you are assuming the answer "Yes" to the question: "Does pure oxygen kill?"

Pure oxygen does not kill. It may be breathed for hours with the greatest benefit by persons who are ill, and it often helps to keep them alive. It is used for this purpose all over the world every day. It is quite reasonable that if a person cannot breathe quickly enough and strongly enough to get into his blood all the oxygen he requires from a volume of air of which only one-fifth is oxygen, he may yet be able to get all he needs if he breathes an air, or atmosphere, which consists entirely of oxygen. When we understand how important oxygen is, we shall see why it is that runners, and even racehorses, are said to run more quickly if they are dosed with oxygen. But we are not certain that this statement is true, or can be borne out, and it would require a great many experiments to make us sure of it. It is quite probable, however.

The notion that pure oxygen is harmful probably has an element of truth in it. If we were all taken to an atmosphere of pure oxygen, and never had anything else to breathe, our living would probably be very much disturbed; it might be that our brains would become far too much excited, and so all sorts of disasters might happen. We do not at all know what would be the effect on a healthy person of breathing nothing except pure oxygen for hours or days at a time; but we shall probably learn all about it before long.

WHY DOES A SENSITIVE PLANT DROOP WHEN TOUCHED?

When we call the plant sensitive, we mean that the plant feels, and there is no doubt that the plant does feel the touch. We must beware of thinking that the plant's feeling is just the same as our own. Yet it is believed that we ourselves can feel just as the plant does. If we look at someone—a child, or anyone else—who is asleep, and then if we move the bedclothes so that the cold air strikes the arm; or if we touch the skin of the face with a feather, the person will move. Now, something has been felt *somewhere*. It is not like the feeling of a person fully awake, but it is very much the same as the feeling of a sensitive plant.

Plants have no muscles, but they have many other ways of moving. They have elastic fibres, and many kinds of fibres which can become shorter or longer, and which, though they are not muscles, really act in much the same way as the fibres that make up muscles. As for nerves, we always think that plants have none, but we are just beginning to learn that, perhaps, they have nerves; by no means the same as the nerves of an animal, but something that does the same work.

If the question means what is the use of the drooping, then we may say that the plant protects itself by shrinking up into smaller space when it is touched. The touch, for instance, might be that of some insect which might hurt the plant, and if the plant droops, perhaps the insect will miss it, and turn to some other plant that does not droop.

WHY ARE THERE NO GREEN FLOWERS?

Every part of a plant has its business, its own special purpose in serving the life of the plant. The leaves exist in order that the plant may get the kind of food it needs from the air, and the green stuff of the leaves is necessary, as we know, for this purpose. The flowers of the plant have a wholly different purpose. They exist, not for the sake of the plant that bears them, but for the production of new plants that shall carry on the life of the parent plant when it is dead. The part of the flower that is usually most conspicuous is the petals, and these, as we learn when we study the way in which the plant develops, are changed or modified leaves.

But they are not green, because, firstly, the plant produces plenty of green leaves in other places; and, secondly, because if they were green they would not be noticed by insects. The plant usually depends upon the visits of insects to its flowers in order that it shall get from some other plant of the same kind, which the insect has already visited, what it needs to fertilize its flowers, so that the seeds in them shall grow into new plants. The insect is therefore helped to find the flowers by the color of its petals being different from the color of the leaves.

IS CHLOROPHYLL THE COLORING MATTER IN RED FLOWERS?

No; the coloring matter of red flowers, and of flowers in general, whether red or blue or white or yellow, is not chlorophyll, but something else, the nature of which differs in various flowers. The business of chlorophyll is to feed the plant by means of sunlight; but the business of the flower is not at all with the feeding of the plant; the flower does not exist for the plant that bears it, but for the future. Its business has to do entirely with the bearing of the seeds from which future plants will spring.

The flower is the part of the plant which is made specially or specialized, as we say, for this purpose. Therefore, we should not expect to find chlorophyll in the flower. The proper place for chlorophyll is in that part of the plant that is concerned with the upkeep and health of the plant in question, not in the part that is given up to the future of the race. If chlorophyll were present in the flowers, it would be very much more difficult for insects to recognize the flowers among the green leaves, and one of the great duties of most flowers is to make themselves conspicuous, in order that the various insects may visit and fertilize them.

There are varieties of chlorophyll which are not so much green as brownish green, or even a rather yellowish green. We find some of these in sea plants, such as sea-weed, but there is no such thing anywhere as a red variety of chlorophyll.

WHY DOES A POTATO NOT ROT UNDER THE EARTH WHILE IT IS GROWING?

If certain kinds of low vegetable life are present in the soil they may attack even the living potato and rot it; the consequences may be terrible if a whole population largely depends on the potato for food. But usually the potato is protected by two things.

One is its skin, which exists in the case of the potato, as it does in many other vegetables and fruits, chiefly in order to keep out microbes and other things that would otherwise feed upon it and rot it. The other thing is the life in the living cells which make the potato, and especially those cells which lie on the outside of it and are the best part of its food-value, which is commonly lost when we pare potatoes before we cook them. These cells, so long as they are alive, have the power, as every living cell has in some measure, of protecting themselves from most dangerous things, such as microbes or insects.

When a potato rots it is because some other living things are using it as their food. The rotting of the bodies of animals and plants is not to be thought of as something really bad or horrible. It is simply a chemical change produced by the life of other living creatures: their life benefits as the thing they feed upon suffers. Rotting is really, therefore, a kind of digestion.

SHALL WE EVER BE ABLE TO GET TO ANY OTHER PLANET?

One of the greatest men who ever lived, Charles Darwin, said that the really unwise people were those who thought it specially wise to say that men would never be able to do or to know this thing or that, and the history of knowledge has justified him. But even when we remember what Darwin said, we are still inclined to think that the answer to this question must be "No." Jules Verne wrote a clever and delightful story about some men who were shot inside a huge cannon-ball to the moon; and even that is certainly not a possible thing now. But the moon is only 240,000 miles away, and the solar system would have to change a great deal for our earth to be within even 20,000,000 miles of another planet. Nothing could fire a hollow ball fast enough to go so far, even if the direction could be controlled, and even if people inside it could survive the shock of being fired off.

But let us suppose that men could invent some machine that made power in itself, and could keep on doing so, such as a flying-machine. The first difficulty is that, when it got very high, even if the passengers took air with them to breathe, there would not be enough air for the machine to work against. In a vacuum—a space empty of air—the strongest bird could not soar or sustain itself. You might as well try to swim at the usual level in an *empty* swimming bath.

Now, suppose this difficulty did not exist. Even then there would be another which would be fatal. The passengers would have to travel millions of miles through the cold of space. None of us can imagine how cold that is, and it is certain that only a few minutes of it would freeze any human being to death. Even if they traveled to Mars with the speed of light—and we are sure they never could—they would certainly be dead before they got there.

SHALL WE EVER BE ABLE TO TALK TO ANY OTHER PLANET?

This is a very different question from the last. Of course, we must assume that the other planet, say Mars, has intelligent beings upon it, which is quite likely. If that were so, there is no real reason why we should not communicate with them in some way. Of course, they would have to learn how to understand what we meant; but that would not be nearly so difficult as it sounds. As a matter of fact, in France, a large prize awaits the first person who establishes communication with any planet, and perhaps someone may one day be able to win that prize. If there are intelligent beings on Mars, they are probably far cleverer than we are, for Mars is a much older world than ours, and there has been more time for these beings to learn and grow wise, if they are there at all. Indeed, perhaps they have been trying to attract our attention for ages, and are wondering when the earth-people will grow wise enough to attend to them. It has been even suggested, though not quite seriously, that the great system of canals on Mars—which is quite big enough for us to "read"—is a huge writing, meant to say something to us.

At any rate, the canals prove that communication between Mars and the earth is by no means an impossibility; and if the people of Mars have telescopes as good as ours, they could certainly read anything we wrote large enough in the Sahara Desert or Siberia.

WILL THE EARTH EVER STOP SPINNING ?

We know now, quite well, that nothing stops spinning or moving about unless something stops it. A top would not stop spinning but for the resistance of the air and the surface it spins on. The question is, then, do we know anything going on now, or anything that is likely to happen in the future, which may stop the spinning of the earth? The answer is, that the tides have this effect, though many ages may pass before it is shown; that perhaps the mere presence of the ether in space has some effect of resistance; and that in all probability the earth will, therefore, stop spinning some day or other.

WILL THE SUN EVER COOL DOWN AND HAVE THE SAME TEMPERATURE AS THE EARTH ?

Yes, this must happen. Indeed, the cooling down must go farther than that, and the sun, if it is to remain as the sun, must certainly become quite cold all through, which the earth certainly is not yet. This need not happen if the sun were to meet some other star, and by the force of meeting be made hot again; but then, of course, it would not be our sun any longer. Our sun would have disappeared, though the stuff of which it is made would remain.

To make something from nothing is an impossibility. Every moment, without ceasing, the sun is giving out enormous quantities of power in the shape of light, and heat, and other things. If the sun were all the time getting from somewhere else as much power as it is giving out, then, as long as that supply is kept up, it need not cool down. Astronomers have very carefully studied this question. The sun gets a certain amount of power from shooting-stars falling into it; it also gets a certain amount of power from the light of the other stars. This is nothing, however, to the power the sun is spending. It must necessarily, therefore, cool down, and become, we have no doubt, like the countless thousands of cold stars or suns which we know exist in the sky.

CAN CHEMISTRY BUILD UP LIFE ?

No, chemistry certainly cannot build up living matter yet, and perhaps it never will be able to do so. But we ought to know how far chemistry can go in this direction. It was long believed that none of the things made by life, such as sugar or alcohol, could possibly be made in any other way.

About a hundred years ago, however, a compound called urea, which is one of those made inside our bodies, was made by a chemist *outside* his body; and now chemistry can build up thousands of compounds which are made by living things, and can build them up from their separate elements. This teaches us that chemistry inside living things cannot be so very different from chemistry outside them. But the compounds of the class of white of egg, usually called proteids, are those which, more than others, distinguish living things; and the chemists are as yet only able to make compounds which are *nearly* proteids, but not quite.

No doubt, chemists will soon be able to make all the compounds that compose living matter, or protoplasm, and then call the mixture protoplasm. But it will be only *dead* protoplasm, we may be very well sure. Living protoplasm is far more than a mixture of proteids and sugar and salts and water. It has an architecture, and is as much more than a mixture of these things as a noble building is more than a heap of bricks. The bricks need a builder to make them into a cathedral, and the compounds that compose living matter need a builder to make them into living protoplasm;

and as that builder is Life, we shall be as far from making life when we can make proteids as we were 100 years ago.

HOW DOES CAMPHOR KEEP MOTHS AWAY?

Camphor, like most other things that have a smell, is what we call *volatile*—that is, it gives itself off into the air in the form of a gas. Like many other volatile things, camphor is an *antiseptic*, a thing that is very bad for the lives of microbes. Now, most things that are poisonous to microbes are poisonous to insects. Indeed, as a rule, a poison to any kind of life is a poison to all kinds of life.

Camphor in large doses would kill a man. The camphor gives itself off into the air around it, and as it is very poisonous to moths, when a moth smells camphor anywhere, it flies away. It is a great advantage when an antiseptic is volatile, and all the most useful antiseptics are volatile. If a thing is not volatile, it can only take effect on anything that actually touches it, and perhaps not even then, unless the thing actually starts to eat it, which is unlikely.

If an antiseptic, such as camphor, is volatile, it flies about in the air everywhere. Of course, as it spreads, the amount of it in the air gets less; and so insects or microbes can get within a certain distance and not suffer; but if they go nearer they would be killed. Everything we put in a drawer to preserve clothes is therefore volatile, and so can protect the whole drawer.

IF OUR SKIN IS WATERPROOF, WHY CAN MOISTURE PENETRATE THROUGH IT?

The skin is truly waterproof, and will let nothing from outside get into it, even if we stay in water for hours at a time. If this were not so, bathing would be a very dangerous business. But the skin is almost everywhere pierced by tiny little tubes that run out through the waterproof layer to the surface, from the true skin that lies underneath it. These tubes carry the sweat which is made by the little glands in the true skin, from which the tubes run. Water could, perhaps, get into these tubes, so that the skin would not be waterproof, if it were not that the sweat is coming out of them. As it does so, it has a forward pressure which forces back anything that might enter. And even if it did enter it could not get far, for it would find itself in an exceedingly tiny blind alley—the inside of the sweat-gland. If we rub into the skin very hard, something, such as cod-liver oil, which the sweat-glands are willing to take into themselves and give to the blood, we can succeed in making it pass in through the skin. Also, by means of electricity, we can make liquid things pass in through the skin. But otherwise it is truly waterproof—in one direction.

It would be a very good thing if men were clever enough to invent waterproof clothing that had the same property as the waterproof clothing with which we are all provided by Nature! The trouble is that our waterproofs are waterproof in *both* directions. They keep the rain out, and that is good; but they keep the sweat in, and that is bad. This is the reason why we soon get so hot and muggy when we happen to be obliged to wear a waterproof on rainy days.

WHY DOES OUR HAIR GIVE US NO PAIN WHEN IT IS CUT?

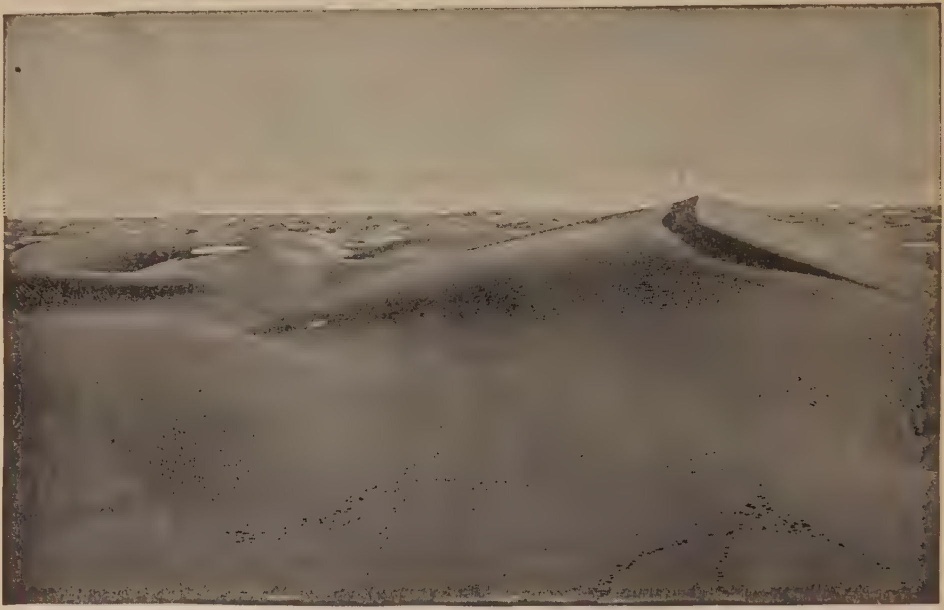
Whenever we feel pain it is because something has disturbed a nerve or nerves that are capable of carrying a message to some part of the brain where there are nerve-cells which can feel pain. If the nerve-cells are out of action because we have chloroform in our blood, we feel no pain. If the nerve has been cut, or has become dead, so that its message cannot be carried, then we feel no pain, even though someone should be cutting off our skin with scissors. And if there are *no nerves* in any part of the body to carry a message, then we cannot feel pain, no matter what is done to that part of the body.

This is the case with hairs. The living root of a hair, where it is made, in the true skin, is supplied with nerves, and so pain is felt if it is disturbed. But no hair in ourselves or in any animal has a nerve in it, and so cutting the hair cannot cause pain. But pulling it does, for that disturbs the hair-root, which has nerves. Nails are much the same as hair, and in the nail itself there are no nerves, so it can be cut without pain. But by far the most curious thing is that the surface of the brain itself has no nerves of the kind that can really feel a touch or a cut; so no pain at all is felt if the brain is touched or cut.

THE NEXT QUESTIONS ARE ON PAGE 4271.

THE WONDER OF A WORLD OF SAND

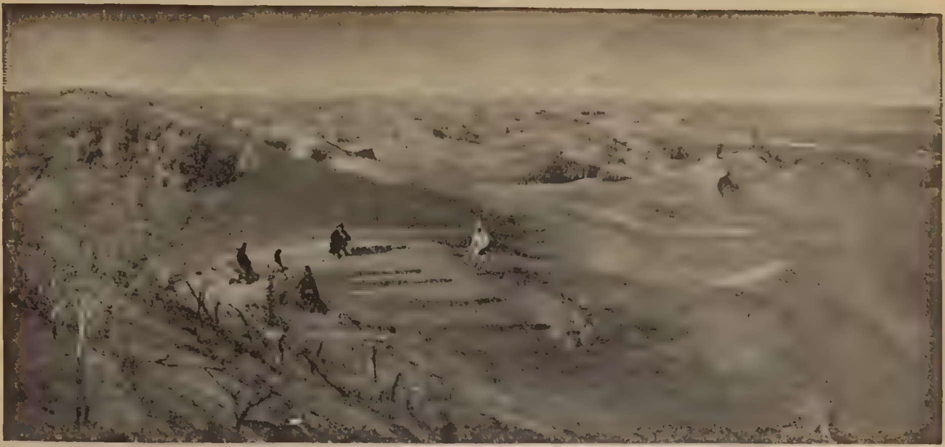
Travelers who have journeyed in the heart of Asia, across trackless deserts of sand that are ever growing wider and wider, have found, deep down under the sand, the ruins of cities, beautiful temples, and extensive forests. Everywhere is evidence that these vast, silent lands were once a flourishing garden, thronged with a prosperous people who traveled, and traded, and manufactured. Great lakes and rivers and a large inland sea watered the country that is now so dry; but an enemy that no man can stand against is ever invading the land, and now the heart of Asia is buried under an ocean of sand, as may be seen in the pictures on these pages. There is one power, and one power only, that brings sound and movement into these dreary, lifeless wastes, says Dr. Sven Hedin, the famous explorer, and that is the wind.



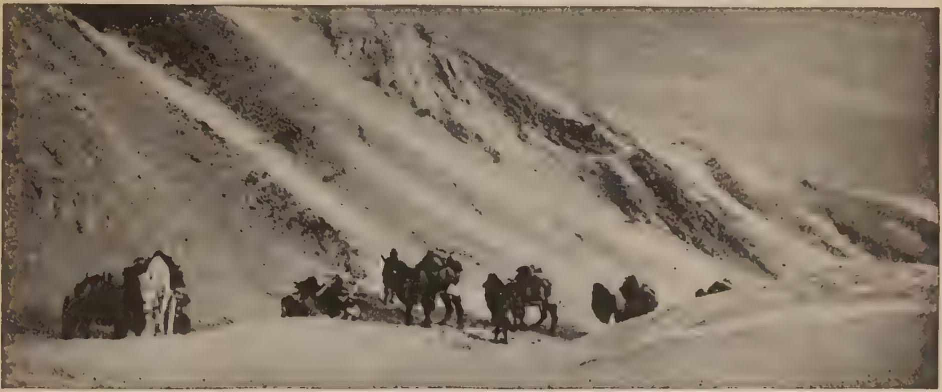
A DESERT OF SAND THAT HAS DRIFTED LIKE SNOW, BURYING GREAT CITIES AND FORESTS

A MOVING HILL OF SAND THAT THREATENS TO COVER A RIVER AND FOREST IN THE DISTANCE

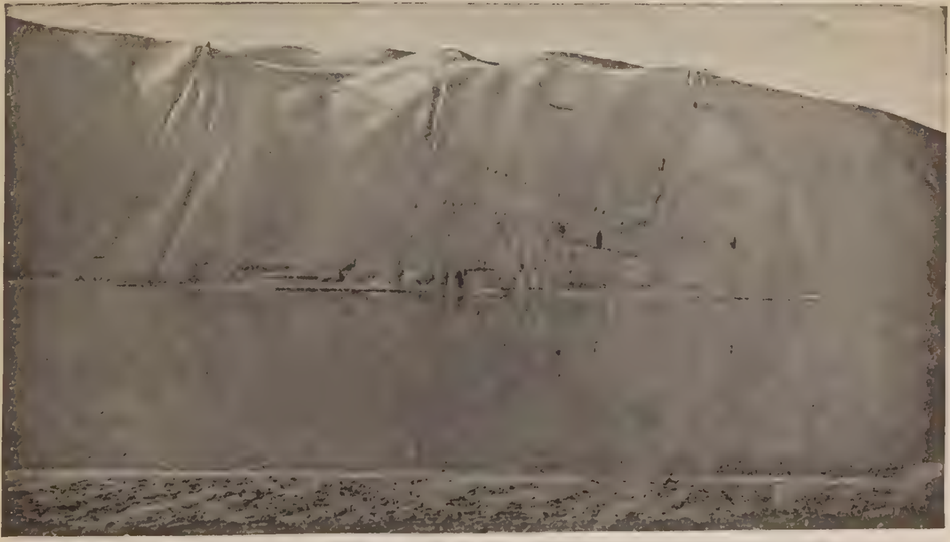
MOUNTAINS BUILT UP BY THE WIND



SAND-HILLS NEAR THE TARIM RIVER, SHOWING THE CURIOUS RIPPLE-MARKS MADE BY WIND

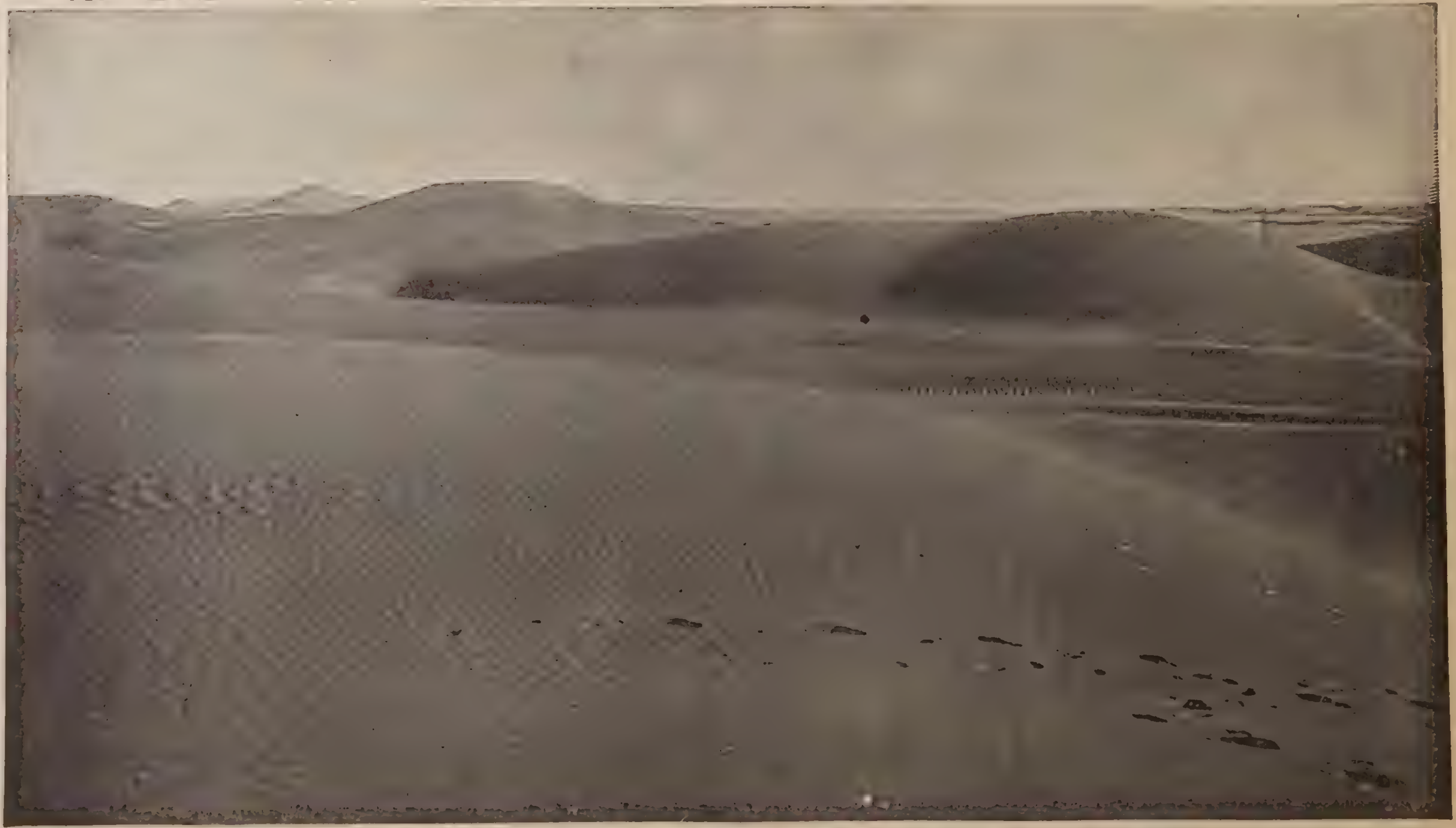


THE ENTRANCE TO A GREAT MOUNTAIN PASS THAT IS FAST BEING FILLED WITH SAND



MOUNTAINS OF SAND OVERLOOKING THE TARIM RIVER, BUILT ENTIRELY BY THE WIND

AN EVER-ROLLING OCEAN OF SAND THAT BURIES A CONTINENT



AS THE WIND BLOWS OVER THE DESERT IT CAUSES WAVES OF SAND LIKE THE SNOW-WAVES SHOWN ON PAGE 2534, WHICH GROW INTO DUNES OR HILLS

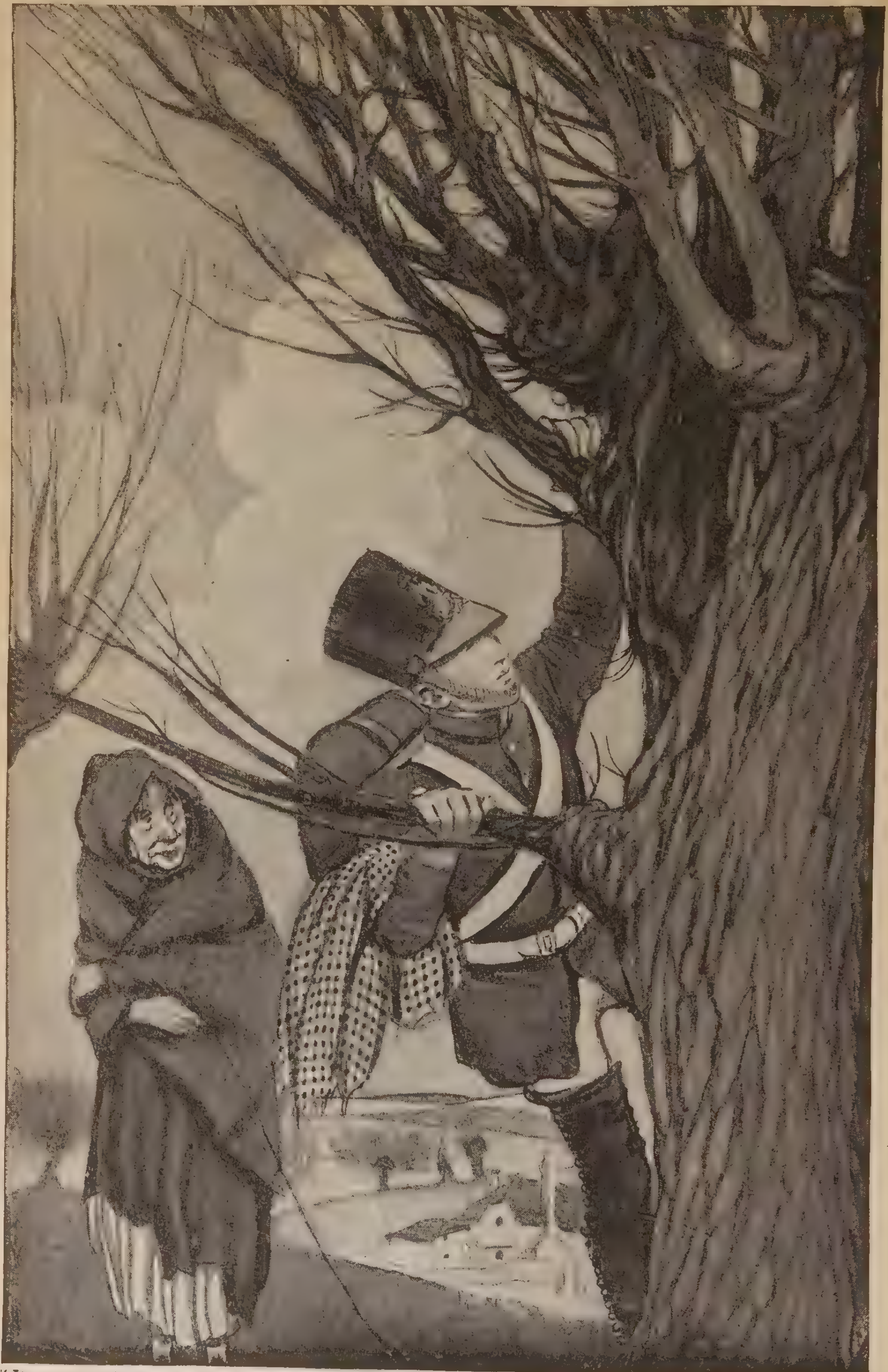
The pictures on these pages are reproduced, by permission, from Dr. Sven Hedin's "Scientific Results of a Journey in Central Asia."

A CAMPING GROUND IN THE DESERT WITH MILES OF SAND ALL ROUND

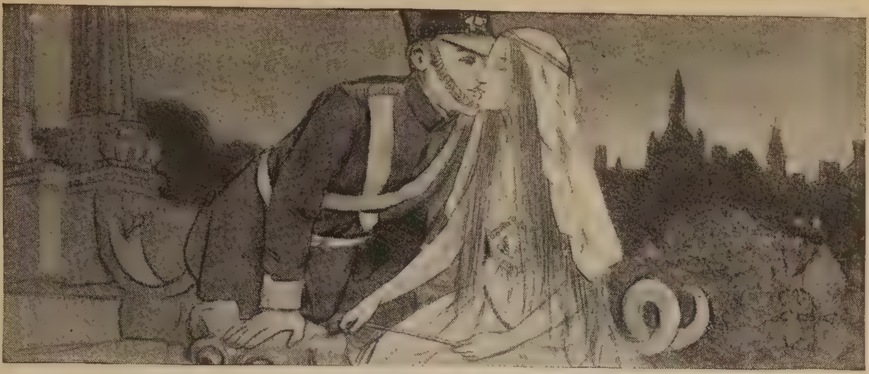
DR. SVEN HEDIN TRAVELED ACROSS THE VAST DESERT OF GOBI, AND DISCOVERED, UNDER THE SAND, THE REMAINS OF RUINED CITIES

THE NEXT BOOK OF WONDER BEGINS ON PAGE 4271.

THE SOLDIER CLIMBED UP THE TREE



"It seems a simple enough matter," said the soldier. "But I should like to know how I am to get down inside the tree." "Fasten this round you, and leave that to me," said the witch, holding out a long rope.



THE MAGIC TINDER-BOX

CONTINUED FROM 4056

TRAMP! Tramp! Tramp!

A handsome young soldier who was returning from the wars, with his knapsack on his back, came upon an old witch standing in the road.

"Good-morning," she said. "It's a fine thing to be rich, isn't it?"

"I don't know," returned the soldier. "I'm so poor that I've not a penny in my pocket."

The old witch came a little nearer.

"Shall I make you rich?" she asked.

The soldier almost dropped his knapsack in his excitement.

"Upon my word," he exclaimed, "I wish you would!"

"Then listen," said the witch. "Do you see that tree yonder? Go near, and you will find a hole in the trunk through which you can let yourself down into a cavern full of treasure. Within are three doors; open one, and you will find yourself in a little room. In the middle stands a chest full of copper coins, and on it sits a dog with eyes as big as teacups. But have no fear; pick him up in your arms and put him on this blue-checked apron which I will lend you, and take all you want.

"If you prefer silver, open the next door you come to, and you will find another little room. In the middle stands a chest full of silver coins, and on it sits a dog with eyes as big as mill-wheels. But have no fear; pick him up in your arms, put him on the apron, and take all the silver you want.

"But perhaps you prefer gold? If so, you must go to the third door. Open it, and you will find yourself in another room. In the middle stands a chest full of gold coins, and on it sits a dog with eyes as big as the Round Tower. But have no fear; pick him up in your arms, put him on the apron, and take all you want."

"I'm sure you're very kind," said the soldier; "but I'll warrant you'll be expecting a nice little pile for yourself!"

"Not a penny," answered the witch. "All I want is my old tinder-box, which my grandmother forgot to bring up with her the last time she was there."

"Well, that seems a simple enough matter," said the soldier. "But I should like to know how I am to get down?"

"Fasten this rope round you, and leave that to me," said the witch.

So the soldier climbed up the tree, and the witch let him down through the hole in the trunk. Down, down, down he went, until he landed safely on the floor of the huge cave, which was ablaze with a thousand lights.

He found a door, opened it, and there, sure enough, on a chest in the middle of the room, sat the dog with eyes as big as teacups. The soldier lifted the dog on to the blue-checked apron, opened the box, and filled his great pockets with copper coins.

"My word, I'm a lucky man!" he said to himself.

He shut the lid, put the dog back on the box, and went out.

Just then he caught sight of another door. Turning the handle, he went in. In front of him stood a great chest, and on it sat a dog with eyes as big as mill-wheels, just as the witch had said.

He picked up the dog, set him on the blue-checked apron, and opened the chest, which was filled with silver.

"This is worth having," said the soldier, tossing out the copper coins, and refilling his pockets with silver.

When they would hold no more he replaced the dog on the chest, and was turning to go when his eye fell upon a third door, which he opened. In the middle of the room stood a chest, and on it sat a huge dog with eyes as big as the Round Tower. The soldier was terrified, but, remembering what the witch had told him, he summoned all his courage, lifted the dog and set him on the blue-checked apron. Then he flung open the lid, and was amazed at the mass of gold coins that lay there before his eyes.

With both hands he grasped his treasure, and thrust as many coins as would go into his pockets. But they were already so full that many of them fell out about his feet.

"Why should I concern myself with silver when all this gold is mine for the taking?" he thought; and, slipping off his coat, he turned it upside down till all the pockets were empty. Then he refilled them with gold, shut the box, put back the dog with eyes as big as the Round Tower, and made his way to the foot of the tree-trunk.

"Don't forget my tinder-box," called out the old witch from above.

"That's just what I have done," said the soldier, turning back.

He found the box, and was pulled up through the tree.

"What do you want with this old box?" asked the soldier, as he stood once more beside the witch. "It must be very valuable."

The old woman made no reply, but kept her eyes fixed on the box.

"Tell me the secret of the box—for I am sure there is one—or I will certainly cut off your head," said the soldier.

"Give me my tinder-box!" screamed the old woman. "You have gold enough, would you rob me of my box?"

"Yes," replied the soldier brutally; for by this time he was sure that she was a wicked old witch who wished to do harm. Then he picked up his knapsack, and made his way to the nearest town.

Here his money brought him many friends. He lived in a fine house, and had a number of servants to wait upon him. For a long time, indeed, he lived gaily in great style; but at last there came a day when his money was all spent, and he was forced to move into a tiny room in the poor part of the town.

As he was sitting alone one evening in the dark—for he was too poor to afford a light—he suddenly remembered the old tinder-box. He dragged it from where it lay almost forgotten, and opened it, and at the bottom, to his delight, he found a piece of flint. He struck it against the box, but no sooner had the spark appeared than the door of the room flew open, and in burst the dog with eyes as big as teacups.

"What commands has my master for his slave?" said he.

The soldier was amazed.

"My word!" he thought. "Then this must be the secret of the tinder-box. It will evidently bring me whatever I choose to ask for."

"Bring me money," he said aloud, whereupon the creature vanished, and in a few minutes he was back again, holding in his mouth a large bag full of money.

Soon the soldier found out that by striking the flint once the dog that sat on the copper chest came to him; by striking it twice the silver dog appeared, and by striking it three times he could summon the guardian of the gold treasure.

That day there was no happier man in all the town. He returned to his grand house, and once more lived a life of gaiety, and had everything he wished for.

Now, in this town there lived a beautiful Princess. It had been foretold that she would one day marry a common soldier, and this so enraged the King that he locked her up in a great copper palace, and allowed no one to visit her but himself and the Queen.

When the soldier heard this story he determined to see the beautiful Princess, come what might. So, summoning the dog with eyes as big as teacups, he bade him bring the Princess without delay.

The dog obeyed, and in a short time appeared with her fast asleep on his back. She was so beautiful that the soldier bent over and gently kissed her hand, and then bade the dog take her safely back to the palace.

The next morning the Princess told the Queen that she had had a strange dream. She had dreamed she was riding on a huge dog, and was taken to a soldier who kissed her hand.

"A pretty dream, indeed," thought the Queen. "I'll find out where she goes."

That night she fastened a little bag of flour to the Princess's waist; but before she went away she took out her gold scissors, and made tiny holes in the bag, so that if she moved about the flour would drop out, and mark the road along which she traveled.

This is just what did happen. The soldier had fallen in love with the beautiful Princess, and that night he again sent the dog to bring her to him; and all the way along, as the dog ran from the palace to the soldier's house, the flour dropped out upon the roadway.

The next morning, when the Princess said: "I had that strange dream again last night, I wonder what it can mean," the Queen rose quickly, and went to the window from which she could see the roadway. And there, sure enough, was the little line of white.

Summoning her servants, she bade them follow that white line, and arrest the man to whose house it led; and so, before an hour had passed, the soldier was arrested and cast into prison.

The next day he was to be executed, and as he was sitting in his cell waiting for the guard to come for him, he thought how different things would have been if only he had had time to bring away his tinder-box. Just then his eye fell upon a little shoemaker's apprentice who was passing the window.

"Hi, boy!" he cried, starting up. "Fetch me my tinder-box, and I will give you a gold piece for your trouble."

Away ran the lad in great glee, and soon returned with the magic box. From that moment the soldier knew his troubles were over. But he allowed the soldiers to lead him to the gibbet, and then when the King and Queen and the whole Court were assembled, amid a great crowd of people, to see the execution, just when, in fact, the executioner was on the point of fitting the rope round his neck, the soldier turned to the King, and said:

"Will it please your Majesty that I should smoke one pipe before I die?"

He spoke so courteously that the King consented; and then, in an instant, the soldier drew out the tinder-box. He struck it once, he struck it twice, he struck it three times, and suddenly all three dogs stood before him—the dog with eyes as big as teacups, the dog with eyes as big as mill-wheels, the dog with eyes as big as the Round Tower.

"Protect me! Protect me!" cried the soldier. "Don't let them hang me!"

Up sprang the three dogs, and in an instant there was a wild scene such as had never before been witnessed in that city. The dogs dashed in among the people, scattering them far and wide. The dog with eyes as big as the Round Tower flew at the King and Queen, and tossed them high into the air. They were not much hurt, but they were very much frightened by the great dog.

Then all the people shouted with one voice:

"We will have the soldier for our King. Set him on the throne, and put the gold crown upon his head. He shall marry our Princess, and rule over us."

They flocked to the gibbet and released their hero, while a party of soldiers marched to the copper palace to escort the lovely Princess to the heart of the city, where all the people eagerly awaited her. As the procession came in sight, they burst out into prolonged cheers, so that it was some time before the Lord High Chamberlain could make his voice heard. And when he announced that the Princess had consented to marry the soldier, they clapped their hands, and cheered till the streets echoed.

The next day there was a royal wedding. The soldier married the Princess, and they lived happily together all their lives.

HOW GOTHAM GOT A BAD NAME

EVERYBODY has heard of the Wise Fools of Gotham. But perhaps we do not know who these men were, or where Gotham is, or exactly what is meant by calling them "Wise Fools."

This is the story: Gotham is a village in Nottinghamshire, England, and one day his Majesty King John, marching towards the town of Nottingham, commanded that his retinue should pass through Gotham meadow. Now, it was popularly thought that any land over which the King passed became ever after a public road; so the men of Gotham, who valued their meadow, took steps to prevent King John from crossing that way. The King, angered by their proceedings, sent his officers to conduct an inquiry in the village.

When the officers arrived, they found some of the men shouting and making a tremendous din over a pond. These noisy fellows had an eel on a string, and were trying, so they said, *to drown it in the pond!* Others were found rolling cheeses down the road—giving them a push and letting them bowl along of their own accord. They were sending their cheeses, they said, to Nottingham Market. Others, in a tremendous hurry, were dragging carts and wagons up a hill. They were going to shade a wood, they said, from the hot rays of the sun. And others were building a hedge round a bush on which a cuckoo had settled, to prevent the bird from flying away.

The officers went away half amused and half disgusted, and reported that Gotham was a village of fools utterly beneath the King's notice.

But others, who knew more of the story, said that there were some very wise fools in Gotham, and so the phrase came to signify folly which was put on for a wise purpose. It was really a compliment to Gotham, not a sneer. A charming old English writer, named Thomas Fuller, says: "Gotham doth breed as *wise* people as any which causelessly laugh at the simplicity."

LA JEUNE FÉE DU LAC VAN

THE ENGLISH VERSION OF THIS STORY IS GIVEN ON PAGE 2316.

UN jeune berger de Mothvey gardait ses moutons, une après-midi, près du Lac Van, dans les Montagnes Noires du Pays de Galles, quand trois jeunes fées sortirent de l'eau et se mirent à jouer sur l'herbe. Toutes trois étaient belles d'une beauté surhumaine, mais la plus jeune était la plus adorable; et le berger tomba éperdûment amoureux d'elle et réussit à la faire consentir à devenir sa femme. Le jour du mariage, la fée sortit du Lac Van apportant, en fait de dot, trois vaches, deux bœufs et un taureau, et la noce fut joyeusement célébrée à l'église de Mothvey.

"Et maintenant," dit la fée à son mari, "rappelez-vous que si vous me frappez trois fois sans raison, je serai obligée de retourner au Lac Van."

Le berger dit que jamais il ne ferait chose pareille, et ils vécurent heureux ensemble et eurent trois fils. Mais quand le berger pria sa femme d'aller chercher un cheval pour se rendre au baptême, elle oublia de le faire, et, sans penser à sa menace, son mari lui frappa l'épaule en lui disant de faire ce qu'il lui avait demandé.

"Une fois," dit la fée.

Bientôt après, ils allérent à une noce et au lieu de s'amuser, la fée pleura tout le temps, comme si elle avait été à un enterrement, et tout le monde était attristé.

"Pourquoi pleurez-vous?" dit le berger en la frappant sur l'épaule.

"Parce que le mariage ne sera pas heureux," répondit-elle. "Et faites attention! Vous m'avez frappée deux fois déjà."

Le berger devint très prudent car il tenait à ne pas perdre sa femme, mais plus tard, à un enterrement, elle scandalisa tout le monde, en riant et en dansant. S'oubliant complètement, le berger la frappa en disant:

"Est-ce le moment de s'égayer?"

"Oui," dit-elle. "L'enfant a échappé aux douleurs de ce monde et est entré dans le Royaume des Cieux. Mais vous m'avez frappée trois fois. Adieu!"

Quand elle pénétra dans le Lac Van, ses bestiaux l'y suivirent. Cependant, quand ses trois fils furent grands, la fée réapparut et leur donna le pouvoir de guérir et ils devinrent tous trois de célèbres médecins.

THE NEXT STORIES ARE ON PAGE 4235.

Italians Gathering Coffee in Brazil.

HOW COFFEE COMES TO US

WHETHER you drink coffee or not you know that millions of people all over the world have one or more cups every day. In another place we have told you of caffeine, which is the important thing in the drink, and of the effect of coffee upon the human body. Here we shall tell you how coffee comes to the table.

WHEN MEN FIRST BEGAN TO DRINK COFFEE

Just when men began to drink coffee we do not know, but at least five hundred years ago it was well known in Abyssinia. There are many stories of how the effect of the plant was discovered, but no one really knows anything about the matter. One story is that some sheep ate the leaves and could not sleep afterwards. The practice of drinking coffee spread over the East and Europeans brought back stories of the wonderful drink. Soon after 1650 " coffee houses " were opened in several European cities and became very popular. King Charles II tried to close them in England because people talked politics while sipping the fragrant beverage and " spread abroad divers false, malicious and scandalous reports."

King Charles did not succeed in closing the coffee houses, and, in spite of all opposition, more and more men learned to like coffee. Nations differ very much, however, in the amount of coffee they drink. The United States uses more coffee than any other nation, but according to population Holland drinks most. The people of Sweden, Norway, Germany and France also drink a great deal. On the other hand the people of the British Empire drink more tea than coffee, except in South Africa, where so many of the people are of Dutch blood. In proportion to population Canada drinks more coffee than Great Britain, but on the whole still prefers tea.

THE COFFEE PLANT GROWS IN MANY PARTS OF THE WORLD

The coffee plant is an evergreen shrub which may grow as high as twenty feet, but is seldom allowed to become more than six or eight feet in height. It flourishes in warm countries all over the world. From Africa it was taken to Arabia, then to India and the islands of the Pacific and Indian Oceans. Coffee from Arabia is called Mocha and this and that grown in Java are highly prized. The New World, however, produces more than the Old. Coffee is grown in the West Indies, in Mexico, and Central America, and in several countries of South America, but four states in Brazil produce much more than all the rest of

Copyright, 1922, by M. Perry Mills.

the world together. We shall tell you, therefore, how coffee is produced in South and Central America. Coffee grows on many kinds of land, but in Brazil the gentle slope of a hill or a mountain, about two thousand feet above the sea, is preferred. Trees are planted in rows and begin to bear when three or four years old.

Following the beautiful, fragrant white flowers, fruits resembling small cherries appear along the twigs. These are often called coffee berries. They ripen six or seven months after the flowers appear and generally contain two coffee beans with the flat sides together. Each bean is covered with a "silver skin," and the two are held together by a thin membrane. Around all is a sweet yellowish pulp covered by a thin skin which turns dark red when ripe. The crop does not appear all at one time, but the shrubs bear flowers and ripe fruit at the same time, and the berries are picked several times in a season. One kind of coffee bean is nearly round, and the berry contains only one bean. Not very much of this is grown.

HOW THE BEANS ARE FREED FROM THEIR COVERING

When the berries are picked they may be treated by the wet or the dry method. In the wet process the berries are raked and shoveled in water until clean and soft. Then they are carried by a stream of water, through a machine which breaks the skins and rubs off much of the pulp, but does not break the thin membrane which holds the two beans together. This loose pulp and the skins are carried away by the water. When the remaining pulp has become soft and loose the berries are spread out to dry.

When very dry and brittle the berries are run through machines which break the membrane and also remove the silver skin. In the dry process the pulp is not removed by water, but the whole berry is allowed to become very dry. Pulp, membrane and skin are removed together, as told above.

When all the chaff and other refuse have been removed the beans go to a separator, which separates the beans of different sizes. They are then packed in bags, and carried by mules, by men, or by boat to the coffee market. There they are again sorted, and beans from different plantations are often mixed to make a desired blend. Next the bags go to the great coffee merchants in different parts of the world, who sell some of this green or unroasted coffee without any further treatment. Sometimes they mix beans from different parts of the world in order to get a coffee of a particular flavor or price. The people to whom this green coffee goes must prepare it for use at home.

Our grandmothers always bought the kind of green coffee they liked, roasted it in a pan or in an oven, and then ground what would be needed for breakfast in a noisy little hand-mill. Perhaps you have seen such a coffee-mill in some old house. Even to-day some people who are very particular about the taste of their coffee still hold to this plan. They say that coffee loses some of its flavor if it is ground more than a few minutes before it is used.

THE COFFEE IS AT LENGTH READY TO USE

More and more, however, the coffee which we find at the grocer's is ready for use in the home. The grayish green beans have already been roasted, and under the influence of heat have increased in size and become a rich golden brown. Roasting must be done very carefully, or the coffee will be spoiled. Often the beans are ground after roasting and packed into air-tight cans or boxes of convenient size, ready for the kitchen.

Not all nations use the coffee bean. The leaves of the plant will make a drink stronger in caffeine than that made from the beans. It is not very pleasant to the taste, but it is drunk in Sumatra. In some parts of the Orient coffee is prepared from the whole berry, pulp and all, which has been dried and roasted, or from the dried pulp alone. Others boil the green beans a long time to make a drink.

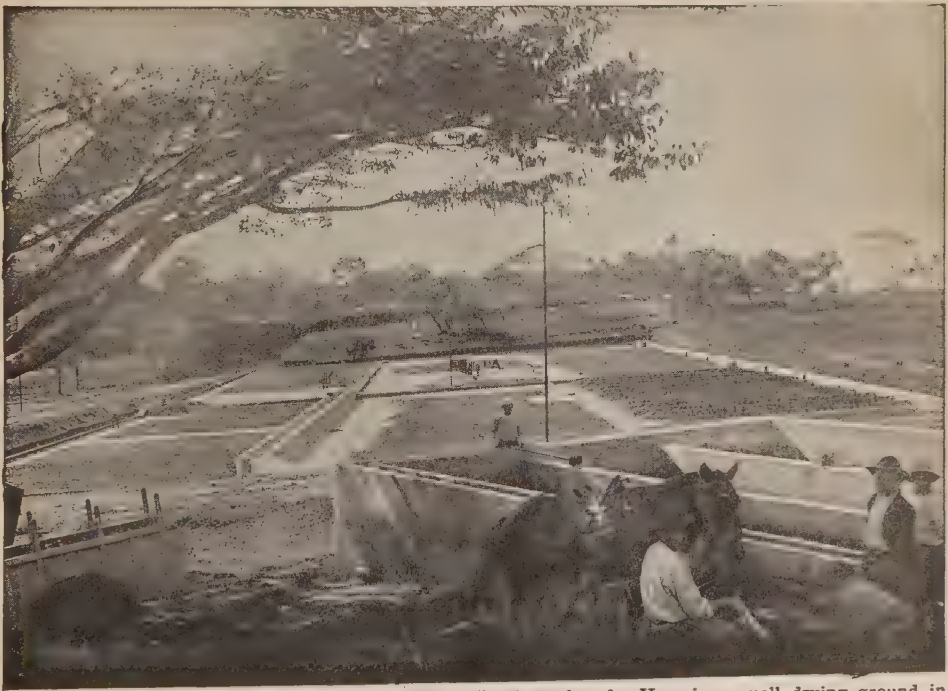
Coffee is prepared for drinking in several other ways in different countries and in different kitchens. Some people boil the ground coffee; others use some sort of a pot or percolator, in which the coffee is not placed in the water, but the boiling water is allowed to drip through the ground coffee. Some people make coffee with a great deal of hot milk; others prefer to use cream, while still others do not like either. Some people do not even like sugar in coffee. "After-dinner coffee" is served clear, with or without sugar.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4143.

BLOSSOM AND FRUIT OF THE COFFEE TREE

The fragrant white blossoms of the coffee tree are a beautiful sight when they appear among the green leaves. The flowers do not appear all at once, but several times in a year. The tree is an evergreen.

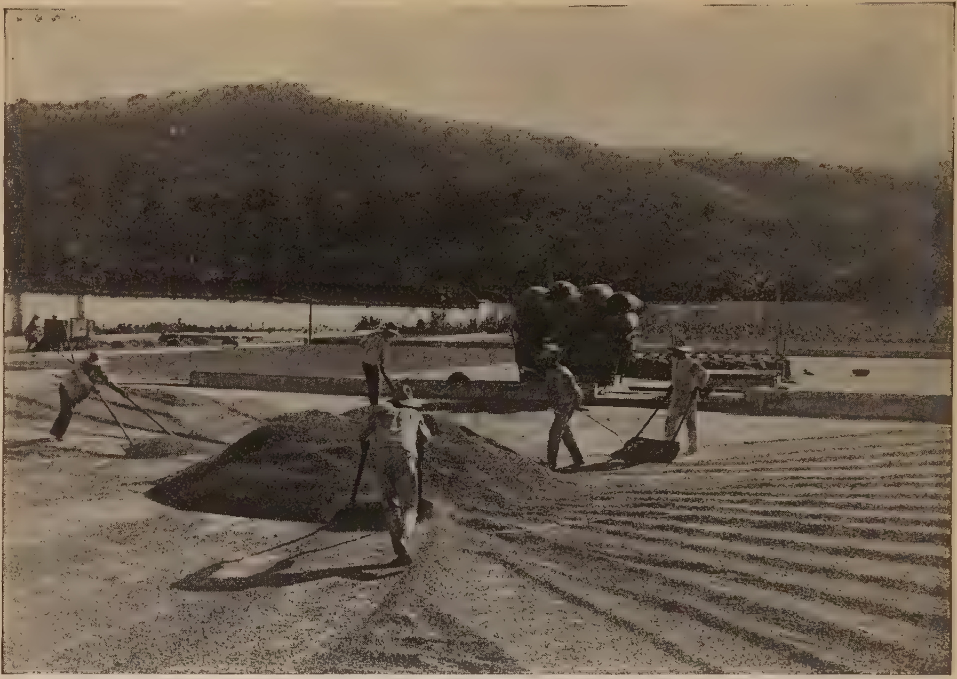
Here are the coffee berries six months after the blossoms. Each berry contains two beans with the flat sides together, surrounded by a thin membrane and sweetish yellow pulp. It looks like a plum.



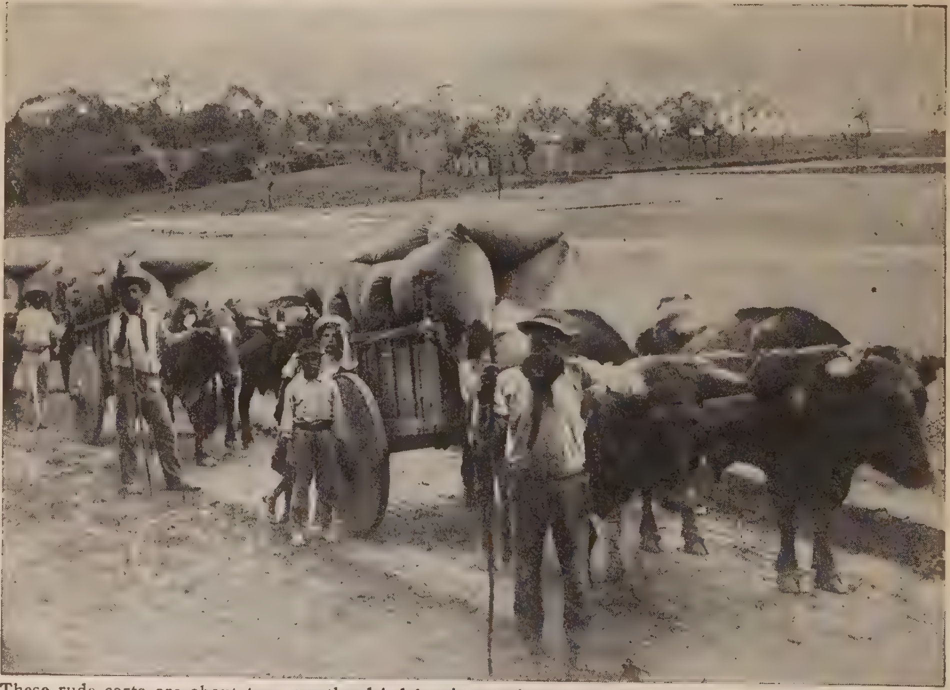
At the first page of our story you may see how coffee is gathered. Here is a small drying ground in Costa Rica. In the foreground are the tanks where the pulp is softened and loosened. On the upper part of the drying ground beyond the berries have been placed in long heaps to drain, and below they have been spread out to dry.

Two upper pictures from Underwood and Underwood, N. Y.

COFFEE ON THE WAY TO THE WAREHOUSE



The coffee beans are now almost dry, and the men are pushing all of them into a pile for the night. In the morning they may be spread again, but it is possible that they may be placed in bags, and started on their way to the warehouse. Part of the open space in the background has been cleared and the coffee is in the bags on the truck. Below we see the dried coffee starting to the warehouse.



These rude carts are about to carry the dried berries to the great coffee warehouses. Notice the clumsy solid wheels and the patient oxen yoked to the carts. Behind you see coffee enough to fill hundreds of bags more. In most of the coffee country the roads are very bad, and only strong vehicles can stand the strain.

Lower picture copyright Underwood and Underwood, N. Y.

IN A GREAT COFFEE WAREHOUSE

These are some of the machines in a great coffee-cleaning plant in Brazil. They separate the coffee beans from the "silver-skin" and the shreds of pulp which adhere, and also divide them according to size. On the whole very little machinery is used in the preparation of coffee for shipment. More machinery can be seen in the establishments which roast and grind the coffee in some of our large cities.

The coffee is almost ready to leave the land where it has been produced. In this basement room of the great warehouse the correct weight is being placed in the bags, which are then sewn up. Next comes the ocean voyage, and it will soon be in the establishment of the great coffee merchants from which your grocer gets his supplies. Except as otherwise noted, pictures loaned by courtesy of the Pan-American Union, Washington.

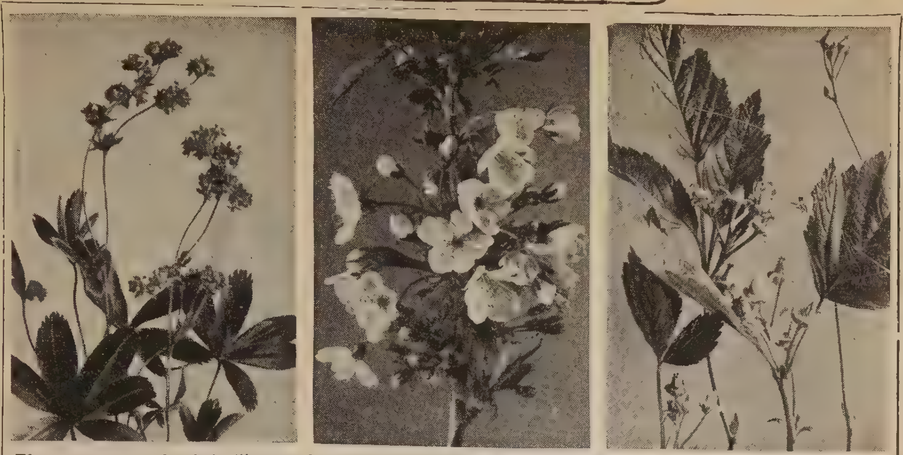
PLANT RELATIONS AND PLANT STRANGERS

Few who have not studied plants would think that the common white clover, or Dutch clover, seen here, belongs to the same family of plants as the pea.

European furze, which seems so unlike both clover and pea, is a member of the same family. Nearly 7,000 different plants belong to the Pea Family.

The European daisy represents the largest of all the families of plants. There are ten thousand different plants belonging to this Composite Family, which includes the thistles, chicory, and dandelion.

This is wild cabbage, that grows on cliffs in Europe. It represents the Cabbage Family, to which belong mustard, horse-radish, various cresses, woad, that gave the blue dye to the ancient Britons, and radish.



There appears to be little likeness between these flowers and yet they belong to the same family as the rose. On the left is Alpine lady's mantle, in the middle wild cherry, and on the right stone bramble.

THE FAMILIES OF PLANTS

CONTINUED FROM 4016

ONE of the chief troubles that confront us when we seek to learn to know the flowers is the very great number of distinct kinds that grow even in our own country. North of Mexico there are perhaps 5,000 different wild flowers, shrubs, and trees; but if we extend our study all over the world, we shall find that there are over 100,000. When we find a flower in the woods or fields and want to know its name, how is it possible to pick it out of a list of 5,000? It is not an easy matter at first, but many men, called botanists, have, by their labors, made the task much less difficult than it seems to us.

They discovered first that many plants, which differ widely in size and habit, in the shape of their leaves and in the color of their flowers, agree in the arrangement of the parts of their flowers and the structure of their fruit.

These resemblances they regard as family likenesses, and by means of them they are able to arrange all these thousands of plants into small groups. Now, instead of hunting blindly through the descriptions of *all* the flowers, we have only to find by its structure to which family it belongs, and then to search through that family for the one that is most like the flower we have found.

In the Story of Animal Life, we learn that animals fall into similar groups. If, in walking through the streets, we meet with a fox terrier, an Irish terrier, a poodle, a mastiff, or a staghound, we know the type of structure so well that we could tell anyone that they are all dogs. And if we go to a zoo, and see a wolf there, we know at once that it belongs to the same family. So, too, with our knowledge of cats—tabbies, black, white Persians, and so on. When we see a lion or a tiger, we know that it is a cat of some kind—that is, one of the cat family. The same rule applies to all living things, whether animals or plants, and the discovery of these family relationships has simplified matters.

One of the first things we ought to do is to get a general idea of the chief characters that mark these families. We may, perhaps, know that our 2,000 wild flowers are divided up into nearly a hundred families, and it will be a pleasant pastime to pick out the flowers of different families in our walks.

Every boy and girl knows the beautiful wild rose, or dog-rose, that covers many hedges with its pink or white flowers in June. Each flower consists of a green ball about the size of a pea, from the top of which spread five ragged green leaves. Above these are the widely spread, broad petals of a delicate pink or white tint, which are also five in number. Spreading over the narrow ends of these petals is a ring of green pins with yellow heads, and right in the centre of this ring is a cluster of hairy threads of a greenish color.

The green ball is called the *receptacle*, and inside it are the *carpels* which contain the seed-eggs. After the flower has fallen to pieces, the receptacle will grow into the red egg-shaped "hip" that makes a fine show on the hedgerows in the autumn. The ragged green leaves are the *sepals*, the five forming the calyx. The five petals, as a whole, are spoken of as the *corolla*. The yellow-headed pins are the *stamens*, and the hairy threads are the *pistils*.

THE ROSE FAMILY

Now, if we were to take a flower from an apple-tree, a plum-tree, a cherry-tree, a may-tree, a blackthorn, a bramble, a mountain-ash, a strawberry, and a meadow-sweet, we should find that in spite of small differences, they are all constructed on the same plan. Between the plants that bear these flowers there is little resemblance. Some are trees, some shrubs, some lowly herbs; but, owing to their flowers being of the same type, they are all included in the great Rose Family.

There are several branches of the family, known by differences in their fruit. The apple, pear, mountain-ash, and white-beam have several tough-skinned seeds, that we call pips, in a horny core, composed of five carpels, or seed-vessels, which is surrounded by firm, juicy flesh. The cherry, plum, and blackthorn have only one large seed in a bony stone, covered with sweet, juicy pulp. In the strawberry, the receptacle itself becomes pulpy, and bears the seeds upon its surface; the bramble and raspberry wrap each seed in a separate globe of juice. Some of the rose family, like the cinquefoil, silverweed, and agrimony, have yellow flowers, and some of them are passed by as buttercups, because of their color; but if they are compared with buttercups they will be found to be quite unlike them. Here, then, among these well-known plants, flowers, and herbs, we may get a good idea of what is meant by a plant family.

THE POPPY FAMILY

The Poppy Family is a small one, and its members may easily be detected. Its flowers are always of regular shape, and have only two sepals and four petals. The sepals drop off when the crumpled petals burst out and smooth themselves. The slender stamens are very many, but they all drop with the petals as soon as the seed-eggs in the big pistil are fertilized. In the true poppies, the pistil is a rounded or club-shaped knob with a sloping roof, on which the lines running from the centre to the edges are the stigmas. In the greater celandine and the horned poppy, the pistil is more slender, and lengthens greatly after the petals have been shed. In the horned poppy, which we may meet with at the seaside, it grows into a curved seed-vessel a foot long. The seed-vessel of the true poppies we all know as a poppy-head.

THE BUTTERCUP FAMILY

The Buttercup Family includes not only plants with an open cup-shaped flower, such as everybody knows a buttercup to be, but also such strange shapes as those of the larkspur and the columbine. They have five sepals, five petals, many stamens, and many pistils, as a rule. Each pistil ends in a little point.

THE CROSS-BEARER FAMILY

The cabbage, cress, stock, mustard, radish, turnip, and a host of field and wayside weeds make up the large family of Cross-bearers—so called because their four sepals and four petals are always placed crosswise. If we look at a flower of stock or wallflower, we shall see what is meant; then we shall always be able to tell one of this numerous family when we meet with it.

There are only six stamens—sometimes fewer—of which two are smaller than the others, and there is only one pistil, which grows into a long, slender pod, which usually splits down the sides to set free the one or two rows of seeds. Over sixty of the wild flowers found in this country belong to this family. With few exceptions, they are not very showy, and therefore are called weeds.

THE VIOLET FAMILY

The Violet Family is quite easily recognized, since its flowers are what are termed irregular, because its petals are not all of the same size or shape. There are five sepals, five petals, five stamens, and one pistil. The violet and the pansy are well known, so we can easily follow the description. One of the petals is larger than the others; this is really the upper petal, but, owing to the fact that the flower-stem always curves over, it appears to be the lowest petal. This petal is continued behind as a spur, or hollow tail, and in it the nectar is produced for the attraction of insects. Two of the five stamens have tails also, which extend back into this spur, and all of them end in flat points, which fit closely around the bent pistil. The stigma is simply a hollow ball.

THE PINK FAMILY

A larger family is that of the Pinks, which will be familiar to us through the pinks, carnations, and sweet-william of the garden. But we have many wild flowers also that belong to this family, among them campion, catchfly, corncockle, stitchwort, and chickweed. They all have their leaves in pairs, and often the lower ends of a pair are joined together around the stem. The flowers are always regular, the sepals and petals four or five in number, the stamens twice the number of the petals, and the pistil ending in two to five stigmas. In the pinks and campions the sepals are all joined together to form a stiff tubular calyx; in the chickweed and stitchworts they are separate. The seed-vessel is either long and cylindrical, splitting at the top into several teeth, or short and round.

THE ST. JOHN'S-WORT FAMILY

We probably know the large, yellow-flowered rose of Sharon that is often grown in gardens, though it is wild in some places. It is a member of the St. John's-wort Family, of which we have a dozen varieties among our wild flowers. They are mostly very upright-growing plants, with slender stems and smooth, oval opposite leaves. The flowers are yellow, with five sepals, five petals, a great number of stamens arranged in separate bundles, and a pistil that ends in three or five stigmas. Some of the plants, if we hold them up to the light, will be seen to have clear little dots on the leaves, as though they had been pierced through with pins; and some have raised black dots and lines along the edges of the leaves, sepals, or petals. The marsh St. John's-wort, that grows in wet places, has trailing stems and rounder, soft, hairy leaves.

THE GERANIUM FAMILY

The Geranium Family, though it includes the large and showy geraniums of the garden and greenhouse, is, so far as our wild plants are concerned, a family with small flowers as a rule. But they are all very pretty, not only in their flowers, but in their leaves also. With the exception of the yellow balsam, or touch-me-not, they all have quite regular flowers. The herb-robert, that grows commonly on wet rocks, and the wood-sorrel, that is abundant in spring in old woods, are among the best known of this family. There are five sepals, five petals, usually ten stamens, and the pistil ends in a stout style, which branches at the top into five stigmas. The plants with regular flowers have five streaks upon their petals pointing the way to the glands where the nectar is poured out. All of them have peculiar seed-vessels, so contrived that, when ripe, the seeds are shot off to a great distance from the mother-plant.

THE PEA FAMILY

The Pea Family is a very large one, and includes furze, broom, the vetches, medicks, and clovers. Most of them have the leaves divided into three or more leaflets, and the flowers are always irregular and of peculiar form. The five sepals are joined together. Of the five petals, one—known as the standard—is very much larger than the others, two others are known as wings, and the two smallest form the keel.

The last two often have their edges joined together, and between them will be found the ten stamens, and the long, curved pistil, whose thickened portion—the *ovary*—grows into the long pod we know so well in the case of the green pea. These pods are not always as straight as they are in the pea, the bean, and the furze. In the clovers it is short, in some of the medicks it is shaped like a reaping-hook, in others coiled on itself like a snail-shell. In this family are included all the clovers and vetches, rest-harrow, and beans.

THE SAXIFRAGE FAMILY

Another large family, of which several members are well known to us, is the Saxifrage Family. They have small flowers as a rule, but these are always very pretty. The four or five sepals are joined together, forming a tube-shaped calyx, from which the five petals emerge. There are five to ten stamens and an ovary with two to four stigmas.

The saxifrages proper are neat little plants, mostly growing on mountain-sides, of which the London pride of our gardens is the best known. This is a wild plant in the west of Ireland.

In the golden saxifrages, that grow along streams and in marshes, the flowers are small and have no petals; but the sepals and leaves adjoining, being bright yellow, make the plants conspicuous.

The grass of Parnassus has a single large white flower. Between its five stamens are five broad scales fringed with knobbed hairs. The currant and gooseberry belong to this family. In the copses of the North we may find red and black currants, and the gooseberry.

THE PARSLEY FAMILY

One of the largest of our plant families is the Parsley Family; and in almost every case when we meet with one of these plants we may know at once to which family it belongs. The flowers are very small, but they are many and are arranged on slender stalks that radiate from the top of a thicker stalk.

If the wind blew our umbrella inside out, and we stripped off the covering, the framework would look just like the flowering stem of one of this family—the stick being the stout stem and the ribs the slender flower-stalks.

In most cases we need a magnifying-glass to make out the structure of the flowers clearly. There is a very simple calyx, sometimes having fine teeth along its rim, to show that it is composed of five united sepals. There are five very tiny heart-shaped petals of white or yellow—bluish in sea-holly—five curved stamens, and a quaint pistil with two stigmas. Some of the plants—such as hemlock and cowbane—are very poisonous; others, such as carrot, parsnip, celery, parsley, samphire, and caraway, are most useful as food or for flavoring.

THE COMPOSITE FAMILY

Largest of all these families is the daisy family, known as the Composite Family, because a great number of tiny, stalkless flowers are packed together to form what is known as a flower-head. What we call a daisy flower is a bunch of about 250 flowers, or florets, of two forms, the outer row with a white strap-shaped corolla, and the inner one with yellow tube-like corollas. If we cut a daisy right through the middle we can see that this is so, and will understand why the family is called composite, or compound flowers. But all composite flowers are not exactly like the daisy; some, like the dandelion, the tansy, and the thistle, have only tubular corollas.

In addition to the flowers named, this family includes, besides others, the asters, dog-daisy, wormwood, coltsfoot, groundsel, chicory, lettuce, sow-thistle, and goat's-beard. Among well-known garden composites are the dahlia, chrysanthemum, and sunflower.

SOME OTHER FAMILIES

There are so many plant families that it is impossible to describe them all. There is the Bellflower Family, of which the harebell, the Canterbury bell, the lobelia, and campanula are examples; and the Heath Family, including, besides heath and heather, the bilberry, the cranberry, and the strawberry tree.

The Primrose Family has, beside primrose and cowslip, such well-known flowers as creeping jenny and pimpernel. To the Gentian Family belong the beautiful blue flowers that give the family its name; also the yellow-wort, the centaury, and the buckbean. The Borage Family gets its name from the borage, whose flowers have a brilliant blue of their own. Other members of this family are comfrey, bugloss, lungwort, forget-me-not, and hound's-tongue.

Besides these families there are the Nightshade Family, the Figwort Family, the Mint Family, the Orchis Family, the Lily Family, the Daffodil Family, and so on. We shall learn the differences between them as we read about the flowers on other pages.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 4205.

South view of Rugby schools and dormitories as they were in the days of "Tom Brown."

TOM BROWN'S SCHOOLDAYS

THIS is a celebrated story of English school life. It was written in 1856 by Thomas Hughes, an eminent lawyer and judge, but, better still, a good man and a friend and helper of the poor. Judge Hughes was born October 23, 1823, and died March 22, 1896. He was educated first at Rugby, under the famous Dr. Arnold, and afterwards at Oxford. This famous story is largely an account of his and his brother's experiences, and we are not far wrong in reading Thomas Hughes where it says Tom Brown. He also wrote "Tom Brown at Oxford," but that is not quite so delightful a book as its forerunner, perhaps because it is more difficult to interest us in the life of a young man than in the doings of a merry schoolboy.

IN the royal county of Berks, and in that part of it known as the Vale of White Horse, lived Squire Brown, Justice of the Peace for the county. He was a man of strong democratic opinions, and had no prejudices against his fellow-men less blessed than he with worldly wealth.

The life of the Brown household had always been simple and uneventful, the squire's chief diversions being a visit twice a year to Reading and Abingdon at the time of the assizes or quarter sessions. Tom's mother was a very practical country lady; and, indeed, her thorough-going qualities had earned for her the title of "Madam Brown." Under the guidance of his alert and sensible mother, Tom's character had been shaped in the right direction from his earliest years; while his father believed in letting him mingle with the boys of the village, instead of keeping him aloof from them, as only by mixing with others are the rough edges of our character smoothed down. For this reason the squire provided the village boys with a fine cricket-pitch, and even supplied them with bats and balls. None of the cricketers were more enthusiastic for the game than young Tom Brown; and while this was excellent in its way, it ceased to be so when Tom's devotion to the game led to his inducing his playmates to stay away from school and play cricket. The village schoolmaster had to complain of this to the squire, and perhaps it was in consequence that Tom was sent off to a private school at the age of nine. His departure from the village was the cause of great regret to all the boys, with whom he had been very popular—perhaps in some degree because he had preferred cricket to study.

His life at the private school was by no means a pleasant change to him. For the first time, he found himself subjected to supervision out of school as well as indoors. The two ushers were weak, characterless fellows, who allowed the older boys too much freedom and were over-strict with the young. Tale-bearing, spying, and all sorts of petty meanness were regular features of the place, much to Tom's disgust. He, however, imbibed a fair amount of Latin and Greek, but in the holidays was constantly wanting the squire to send him to a public school.

Great was his joy, therefore, when in the middle of his third half-year, in October, 183–, fever broke out in the village, and, the master having himself slightly sickened of it, the whole of the boys were sent off at a day's notice to their respective homes. The squire was not so pleased as Master Tom to see that young gentleman's brown, merry face appear at home some two months before the proper time for Christmas holidays; and, thinking what had best be done with him, he decided to send him to the famous school at Rugby, where the headmaster had kindly agreed to let him enter at once for the last six weeks of the term.

Tom's father accompanied him into London to see him off in the Tally-ho coach for Rugby, and gave him, in his own blunt way, some good advice.

TOM BROWN IS TO GO TO RUGBY SCHOOL, AND RECEIVES SOME GOOD ADVICE

"And now, Tom, my boy," said the squire, "remember you are going, at your own earnest request, to be chucked into this great school like a young bear, with all your troubles before you. If schools are what they were in my time, you'll see a great many cruel things done and hear a deal of bad talk. But never fear. You tell the truth, keep a brave and kind heart, and never listen to or say anything you wouldn't have your mother and sister hear, and you'll never feel ashamed to come home or we to see you."

It was three hours before dawn that the Tally-ho left the Peacock Inn at Islington with Tom seated on the top; and a stage-coach journey on a cold November night for a boy of ten was certainly no joke, so that long before Rugby was reached the young passenger on the roof had learned a very useful lesson in endurance.

From the old guard of the Tally-ho Tom heard many tales of life at Rugby and of the pranks played there by the schoolboys. So eager was he to know of the new life into which he was to enter that he plied the guard with question after question, until the old fellow not only brushed up his memory, but drew a little on his imagination, though all he said was accepted by Tom in perfect faith.

"Werry out-o'-the-way place, sir; no paving to streets, nor no lighting," was how he pictured Rugby. "Mazin' big horse and cattle fair in autumn—lasts a week; just over now. Takes town a week to get clean after it. Belong to school, sir?"

WHAT THE OLD GUARD OF THE TALLY-HO TOLD HIS YOUNG PASSENGER

"Yes," said Tom, not unwilling for a moment that the guard should think him an old boy. But then, having some qualms as to the truth of the assertion, and seeing that if he were to assume the character of an old boy, he couldn't go on asking the questions he wanted, added: "That is to say, I'm on my way there. I'm a new boy."

The guard looked as if he knew this quite as well as Tom.

"You're werry late, sir," said the guard; "only six weeks to-day to the end of the half." Tom assented. "We takes up fine loads this day six weeks, and Monday and Tuesday arter. Werry free with their cash is the young gen'lemen. But, bless you, we gets into such rows all 'long the road, what wi' their pea-shooters, and long whips, and hollering, and upsetting everyone as comes by; I'd a sight sooner carry one or two on 'em, sir, as I may be a carryin' of you now, than a coach-load."

"What do they do with the pea-shooters?" inquired Tom.

THE STIRRING STORY OF THE BATTLE OF THE PEA-SHOOTERS

"Do wi' 'em? Why, peppers everyone's faces as we comes near, 'cept the young gals, and breaks windows wi' 'em too, some on 'em shoots so hard. Now, 'twas just here last June, as we was a-driving up the first-day boys, they was mendin' a quarter-mile of road, and there was a lot of Irish chaps, reg'lar roughs, a-breaking stones. As we came up, 'Now boys,' says young gent on the box—smart young fellow, and despret reckless—'here's fun! Let the Pats have it about the ears.' 'Easy there, sir,' says Bob— that's my mate, the coachman — don't go for to shoot at 'em, they'll knock us off the coach.' 'Hang it, coachee,' says young my lord, 'you ain't afraid. Hoora, boys, let 'em have it!' 'Hoora!' sings out the others, and fill their mouths chock full of peas to last the whole line. Bob, seeing as 'twas to come, knocks his hat over his eyes, hollers to his 'osses, and shakes 'em up, and away we goes up to the line on 'em, twenty miles an hour.

"The Pats began to hoora, too, thinking it was a runaway, and first lot on 'em stands grinnin' and wavin' their old hats as we come abreast on 'em; and then you'd ha' laughed to see how took aback and choking savage they looked, when they get the peas a-stinging all over 'em. But, bless you, the laugh weren't all on our side, sir, by a long way. We was going so fast, and they was so took aback, that they didn't take what was up till we was half-way up the line. Then 'twas look out all, surely.

"They howls all down the line fit to frighten you, some on 'em runs arter us and tries to clamber up behind, only we hits 'em over the fingers and pulls their hands off; one as had had it very sharp act'ly runs right at the leaders, as though he'd ketch 'em by the heads only luck'ly for him he misses his tip, and comes over a heap o' stones first.

HOW THE "YOUNG GEN'LEMEN" PAID FOR THE DAMAGE THEY HAD DONE

"The rest picks up stones, and gives it us right away till we gets out of shot, the young gents holding out werry manful with the pea-shooters and such stones as lodged on us, and a pretty many there was, too.

"Then Bob picks hisself up again, and looks at young gent on box werry solemn. Bob'd had a rum 'un in the ribs, which'd like to ha' knocked him off the box, or made him drop the reins. Young gent on box picks hisself up, and so does we all, and looks round to count damage. Box's head cut open and his hat gone; 'nother young gent's hat gone; mine knocked in at the side, and not one on us as wasn't black and blue somewheres or another, most on 'em all over. Two-pound-ten to pay for damage to paint, which they subscribed for there and then, and give Bob and me an extra half-sovereign each; but I wouldn't go down that line again not for twenty half-sovereigns."

After this graphic description the guard shook his head slowly, and got up and blew a clear, brisk toot, toot.

"What fun!" said Tom, who could scarcely contain his pride at this exploit of his future schoolfellows. He longed already for the end of the half-term that he might join them.

Tom had not time to alight from the stage-coach, as it slowed down at Rubgy, before one of the boys came running from the school, and, jumping up behind, announced to Tom that his name was East, and his aunt, who lived down in Berkshire, had written to him to look out for young Tom Brown.

TOM ARRIVES AT RUGBY AND FINDS AN UNEXPECTED FRIEND THERE

This was indeed a jolly reception for the lonely traveler, and he and East were chums at once, for the lad was of a frank and friendly disposition, and introduced Tom to all his own particular friends forthwith.

Nothing could exceed the new boy's interest in all the features of the famous school; the study-room, with its sporting pictures, its cricket-bats, fishing-rods, and climbing-irons, seemed to him more interesting than Windsor Castle itself. At the dinner-table he was a little subdued; but to East's tales of the football field and its numerous accidents he listened as to the battle stories of a veteran. In the big room all the scholars now assembled to answer to their names, and it was with a thrill of pleasure Tom made his first response as a public-school boy.

Tom was in luck's way, for this day of his arrival was signalized by the School-house match, in which East counted himself a tremendous hero to be permitted to play on the School-house side.

TOM'S FIRST GREAT FOOTBALL MATCH, AND HOW HE ACQUITTED HIMSELF

It was indeed a great sight for Tom, this first football match on a grand scale in which he was to take his place. For the School-house team of some fifty boys, who were distinguished by white trousers, in which they felt abominably cold that November day, had to meet and do battle with all the rest of the school.

Such excitement Tom had never witnessed. Nothing approaching the scrimmages had he ever imagined, and in this breathless match Tom was to have his share. For the ball rolled slowly in behind the School-house goal, not three yards in front of a dozen of the biggest School players-up.

There stood the School-house præposter, safest of goalkeepers, and Tom Brown by his side. Now is your time, Tom. The blood of all the Browns was up, and the two rushed in together, and threw themselves on the ball, under the very feet of the advancing column; the præposter on his hands and knees arching his back, and Tom all along on his face. Over them toppled the leaders of the rush, shooting over the back of the præposter, but falling flat on Tom and knocking all the wind out of his small carcase.

OLD BROOKE, THE CAPTAIN, DECLARES TOM IS A PLUCKY YOUNGSTER

"Our ball," said the præposter, rising with his prize. "But get up there, there's a little fellow under you."

They were hauled and rolled off him, and Tom was discovered a motionless body.

Old Brooke, the captain of the eleven, picked him up.

"Stand back, give him air," he said; and then feeling his limbs, added: "No bones broken. How do you feel, young 'un?"

"Hah-hah," gasped Tom, as his wind came back, "pretty well, thank you—all right."

"Who is he?" said Brooke.

"Oh, it's Brown, he's a new boy; I know him," said East, coming up.

"Well, he's a plucky youngster, and will make a player," said Brooke.

And five o'clock struck. "No side," was called, and the first day of the School-house match was over.

THE NEW CHUMS GOSSIP BY THE FIRE AND PREPARE FOR "THE SINGING"

Tom soon recovered from his shock, entering with real zest into the life of the school. Over the fire they sat discussing the great match and other adventures of the football field until it was time to go to their rooms and wash up for the singing.

"What's that?" Tom asked; and East explained that on the last six Saturdays of the term there was singing, as there were no first lessons to do, and "you can lie in bed to-morrow morning."

"But who sings?" asked Tom.

"Why, everybody, of course; you'll see soon enough. We begin directly after supper and sing till bedtime."

Supper-time came in due course at seven o'clock. The meal consisted of bread and cheese and beer, which were all saved for "the singing"; and directly afterwards the fags went to work to prepare the hall. Each new boy of that term was placed on the table in turn and made to sing a solo, under the penalty of drinking a large mug of salt and water if he resisted or broke down. Tom sang an old West-country song, "The Leather Bottél." Many jolly songs were sung, particularly when the fifth and sixth form boys came in, and old Brooke, who was already a hero to Tom, made quite a good little speech as he was so soon to leave the school after eight years.

"Now, I'm as proud of the house as anyone," he said. "I believe it's the best house in the school, out-and-out. But it's a long way from what I want to see it. There's a deal of bullying going on, and depend on it, there's nothing breaks up a house like bullying. Bullies are cowards, and one coward makes many; so good-bye to the School-house match if bullying gets ahead here."

TOM BROWN COMES IN FOR HIS TOSSING IN THE BLANKET

Old Brooke's speech, which was quite a long one for him, was received with great applause and approval, and many glances were made in the direction of Flashman and other fifth form boys who delighted to bully their juniors. The singing meeting was ended by the entrance of the head-master, cap on head and book in hand, who led the whole company in prayers, after which they indulged in the time-honored custom of tossing the new boys in a blanket, an ordeal through which Tom went without flinching.

Thus began Tom Brown's life at Rugby, and a more exciting day for his entrance there could not have been chosen. He shared the fun of it with the new boys who had been there from the beginning of the term. The sermon which he heard the doctor preach on the Sunday revealed to him the strong and noble character under whose guidance he had been placed. For every boy in the school was sooner or later bound to come into personal touch with the head-master. Tom was installed in the third form, but as he had already been well grounded in grammar, the master considered he had been placed too low, and gave so good a report of him at the end of the term that he won his remove to the lower fourth, where all his School-house friends were, so that his delight in being a Rugby boy was now supreme.

When Tom returned to Rugby for the beginning of the second term, and found himself the possessor of a desk in the lower fourth, that was something of a temptation to him, as he used the desk for other purposes than study, and was thrashed in consequence, while the whole form made a very poor appearance before the head-master at the monthly examination. Tom's reputation for steadiness suffered in consequence, but there was another direction in which he ought in fairness to have recovered his good name.

THE TWO CHUMS TEACH SOME OF THE BIG BULLIES A NEEDFUL LESSON

Flashman, the most notorious of the bullies, was so unfair and even brutal to the younger lads whom he made to fag for him that Tom and East, on whom the bully had also tried his work, decided to rebel, and maintained a steady opposition to Flashman and his friends. It was not that they objected to doing the duty of fags, which was expected of them by the fifth form, but simply as a protest against the bullies, and the youngsters succeeded in inflicting a severe punishment upon Flashman.

But the result of it was that Tom and East gained the reputation of shirking fag duty, and Tom, having broken other rules of the school, particularly one as to fishing from a prohibited part of the river Avon, found himself before the head-master and in danger of expulsion, unless he undertook to mend his ways. This he did, and was as good as his promise, for on his return to school next term he was invited by the wife of the head-master to take tea with her, and was told he was to have the Gray study, which was a favorite one, and that she would like it if he would take under his care a new pupil, named George Arthur, who was in delicate health, and had never before been away from home. Somewhat reluctantly, Tom undertook this responsibility, as it would interfere with other private plans of his. Arthur proved a gentle young lad, who, in the dormitory that night, unlike most of the boys, knelt by the side of his bed for prayers, and was jeered at in consequence by one of the others, who threw a slipper at him. Tom quickly met the situation by letting the boot he had just pulled off fly at the head of the bully.

TOM AS THE CHAMPION AND DEFENDER OF ONE OF THE NEW BOYS

"If any fellow wants the other boot," he exclaimed warmly. "he knows how to get it!"

The little scene had an influence on some of the boys in the room, and on Tom most of all. Next morning he began the day by silent prayer at his bedside, and there were others who followed his example. This was the immediate result of his taking care of Arthur.

Arthur was greatly interested in birds and animals, and soon made friends with Martin, one of the school's curious characters, who tamed snakes and kept birds in his study. Together they went exploring in the woods, and Tom had more than once to get them out of scrapes. It was over Arthur, too, that Tom had his last fight in the school with a bully named Williams, who had promised to thrash little Arthur for some fancied insult. He was challenged by Tom, and the fight was at its hottest, with Tom getting the best of it, just as the doctor arrived to put a stop to it. Williams profited by the encounter, as it cured him of his bullying, and made him a firm friend of Tom's.

THE HAPPY TRIO, AND HOW THE WEAKEST HAD THE GREATEST POWER

Two years after the events recorded, Arthur, who was now sixteen, and was an apt and bright scholar, was at the head of the twenty. Both Tom and East were far less successful in their studies, and were none too highly placed in the fifth form. It was a very happy friendship, however, for Tom and East, with their fine manly characteristics and their physical powers, felt the refining influence of Arthur's gentler nature, and were the better in consequence, while he was sheltered from the buffetings of the school by having such manly chums.

Arthur was one of several scholars who took the fever and had to be sent home until he was recovered. Before going away he said to Tom there was one favor he had to ask of him. It was that he would give up the *vulgus* books and cribs, by which he meant that Tom had not been doing his Latin and Greek exercises honestly, but using translations. Tom looked away at this, and then, catching his friend's gaze, asked: "Why?"

"Because—because you're the honestest boy at Rugby, and that isn't honest."

Arthur soon brought Tom to his way of thinking, and had his promise. East had also been guilty of cribbing, like Tom, but he was now brought to honest study as the result of Tom's promise to Arthur, and from that time forward both derived a satisfaction and pleasure from their studies which before had been unknown to them.

TOM'S LAST YEAR AT RUGBY SCHOOL, AND WHAT HE LEARNED THEN

So two more years passed away, and it was again the end of the summer term. An important cricket match was to take place, and there was a union of old boys. On the slope towards the cricket ground stood three of the elder scholars. There was one slight of build, with bushy eyebrows and a dry, humorous smile, while by his side was another of manly form, almost six feet tall, tanned of face, with curly brown hair and sprouting whiskers, his laughing eyes gleaming below his smart straw hat. He was dressed in a white flannel shirt and trousers, with the captain's belt about his waist, and on his feet were yellow cricket shoes. This was our hero, Tom Brown, now nineteen, a præposter, or monitor, and captain of the eleven. East was he of the bushy eyebrows, and the third slight but well-knit and active figure was Arthur, greatly improved physically and as bright as ever.

The master of Tom's form came up just then and invited Tom to sup with him. At that meal Tom learned for the first time how the great and noble man who was the head-master of Rugby had carefully planned for the molding of Tom Brown's character. Tom had fondly supposed his progress was due largely to his own foresight, but now he could understand that it was by choosing him as a protector of Arthur, thus giving him a new sense of responsibility and trusting him, and by many other little things, which he now saw in a new light, that the great Dr. Arnold had brought out the best of what was in his scholar's nature.

AFTER HIS RUGBY DAYS TOM MAKES A PILGRIMAGE TO THE OLD SCHOOL

It was the year 1842, when Tom was on a fishing holiday in the Scottish Highlands, that his companion, reading from a newspaper, said: "Here's something for you, Tom. Why, your old master, Arnold of Rugby, is dead."

"Let me look at the paper," said Tom, greatly agitated, and, turning over the leaves with trembling hands and swimming eyes, he managed at length to read the short announcement. Reading it again, he walked rapidly towards the inn, consulted the steamboat and railway guides, and hastening to his room, was gone in an hour. In a day and a night he had reached Rugby, and at the school he found the old verger, Thomas, who looked up at him through his spectacles, and Tom seized his hand and wrung it.

"Ah, you've heard all about it, sir, I see," said the verger.

"Yes. Where is he buried?"

"Under the altar in the chapel, sir. You'd like to have the key, I fancy."

THE DEATH OF THE HEAD-MASTER, AND HOW IT AFFECTED HIS OLD PUPIL

In the chapel all was still as death, and, groping his way almost blindly there, Tom went to his old seat and bowed his head, while the tears came quickly to his eyes. A strange sense of loneliness was with him, the consciousness of a great loss. At the altar he prayed until he felt the peace that comes from prayer, and then, going out into the fresh air, he walked about the close and the cricket fields and up to the old school grounds. Nothing was changed, yet the saintly Dr. Thomas Arnold, the life and soul of it, was no more.

But the teaching of him who was gone still endured and influenced the young man who stood there, conscious that what remained for him to do was enough for all: to labor and be true and strong.

THE NEXT FAMOUS BOOKS ARE ON PAGE 4223.

"Their Furrow Oft the Stubborn Glebe has Broke."

THE LIFE OF THE EARTH

CONTINUED FROM 4128

EVERY year a miracle takes place before our eyes. We look over the country one day, and as far as we can see the earth is dull and brown, the bare branches of the trees point their skeleton fingers toward the sky, except where the dark, sombre evergreens stand out in the gray-brown landscape. Here and there patches of snow still cling to the hillside, or lie in the wood.

A warm wind comes up from the South, and breathes upon the snow. It disappears, and then the rains come, not hard and cold and dreary, but soft and gentle; the earth and air seem saturated with water. The air is not clear, but hazy, and the distant hills are not sharp and clear. The sun shines and the air is filled with mellow light. We say that we can feel the promise of spring.

THE GLORY OF SPRING BURSTS UPON US

A few of these warm, balmy days pass, and we look out on the fields again, but they do not seem the same. We cannot say that they have changed much in color, but they no longer appear cold and unfriendly. We stoop down and discover the reason. Under the old dead grass is a sprinkling of yellow green. New shoots are pushing up from the earth. The trees seem veiled, and the branches are no longer harsh and ugly. The young shoots look different, and here and there are little knobs. Another week and the yellow sprays of the forsythia sway in the wind. Violets are under our feet. The peach blossoms spread their pink glory over the orchards, the pink and white apple blossoms scatter their scent everywhere. The blossoms of the elm and the oak are in the air or on the ground. Tender green leaves push themselves out on the twigs. Spikes of green stand like soldiers in the flower beds, and the jonquil, the daffodil and the narcissus burst out. The dandelions dot the grass like yellow stars. The full glory of spring is upon us.

How it happens no one can explain. The bulb which was placed in the earth in the fall had all the glory of the flower concealed in it, but why one bulb should develop into a yellow tulip, another should be red, and another white, no one can explain. One of two seeds, apparently exactly alike, swells, sends out rootlets, which spread around under the earth, and a spike which seeks the light; another lacks something and lies in the earth until it rots and goes back to the earth from which it came in the first place.

We say that one has life in it, and that this life under favorable conditions of warmth and moisture bursts out of the shell, and seeks to grow. The other

Copyright, 1918, by M. Perry Mills.

seed, or grain, has lost its life and will not grow. When you plant a bed with flower seeds, when a farmer buries his seeds in the ground, some of the seeds will send out roots and stalks, some will remain where they are placed until they are destroyed. Why this is true, the wisest man cannot tell.

WHAT A PLANT MUST HAVE IN ORDER TO GROW

Our pictures show you how the earth is prepared for the seeds. We know that a seed must have many things in order to grow. It must have warmth, moisture, phosphorus, nitrogen, iron and potash, and many other things. Some of these the plant cannot use in their pure form, but must take them from combinations of these substances with other things. If the same crop is planted year after year in the same field, it takes all of some of these substances which the ground has to give, and the plants do not thrive. If we wish the seeds to give us back many seeds, we must supply food for the plants. This is one of the most beautiful things in nature.

One of the best foods for plants is manure from the stables. The animals do not use up all the valuable substances in the food they eat. This waste, mixed with the straw or leaves of their bedding, is mixed with the soil and the plants eat it greedily. It also helps the plants to feed on substances already in the soil. Many other things give the substances which plants feed upon. There is much nitrogen in the blood from slaughter-houses, in cottonseed meal, and in the fish heads and other waste from the fisheries. Then, too, we can get the nitrates from the deserts of Chile, and from other places. We think of some of these as ugly things, but this is a foolish thought. If Nature did not use the same things over and over again, this earth would have become a desert ages ago; and is it not beautiful that these unpleasant things can be changed by Nature's wonderful chemistry into the fragrant rose or the nourishing wheat?

Plants must have a great deal of phosphorus. In many places there is much of this substance in rocks, which are crushed to send to other places less fortunate. Ground bones give out their phosphorus to the growing plants. The waste from steel mills, which make steel from ores rich in phosphorus, is used also. The third substance which must be supplied to growing plants is potash. Some of it is dug out of the ground in some parts of the world, ashes from burned wood have a great deal, and some varieties of seaweed are burned to get potash.

DIFFERENT CROPS NEED DIFFERENT QUANTITIES OF THESE FOODS

Sometimes a soil needs all three of these. Sometimes it has enough of one, but needs the other two. Some plants need more of one than of another. Therefore, men mix these substances in different proportions for different crops. For example, wheat must have large quantities of nitrogen. Some crops, such as clover, peas and beans, can get more than enough nitrogen from the air, but they must have potash, and so must potatoes. Fruits need potash also. Cotton needs the phosphates, and so on. The farmer must know his soil, and what his crops need if he is to feed them properly.

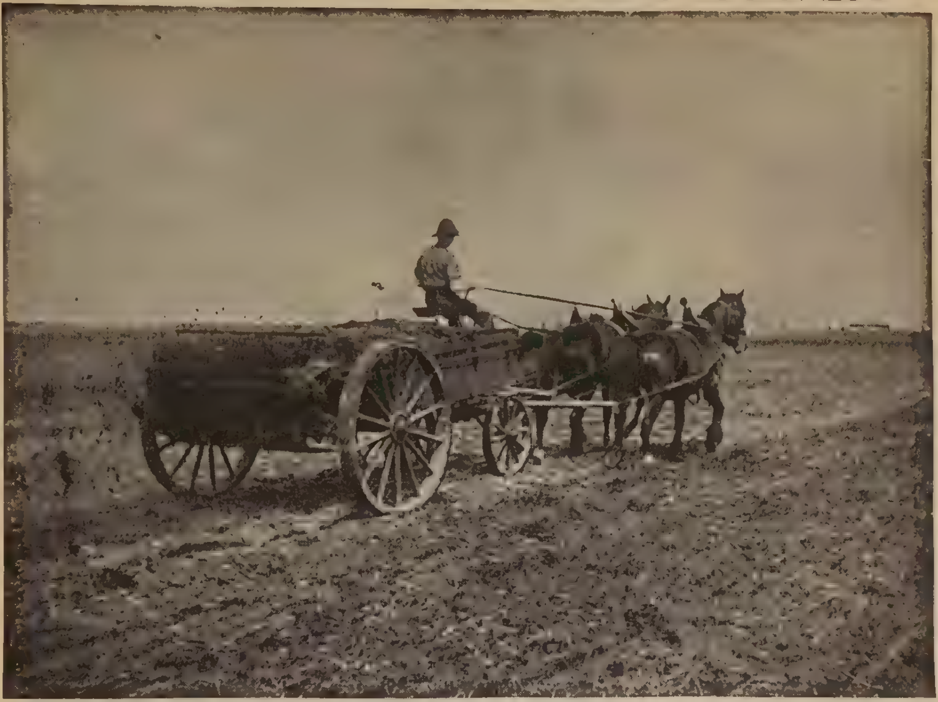
But feeding plants is not all. They must be treated properly in other ways. So he must plough the land deep to loosen it, so that the roots of the plant can find their way through the soil. The lumps and clods must be broken up, so that the earth will lie closely around the seeds and roots, and so that the fine earth will hold in the moisture which would otherwise escape. Ground which is ploughed and harrowed until the earth is fine and smooth will produce larger crops than if it is left full of great lumps of earth or sod. Then, too, different seeds must be planted differently. Tiny seeds generally need only a slight covering; other seeds do better if they are buried deep in the soil. Some must be planted close together; others must have room to grow.

HOW NATURE'S MIRACLES TAKE PLACE EVERY YEAR

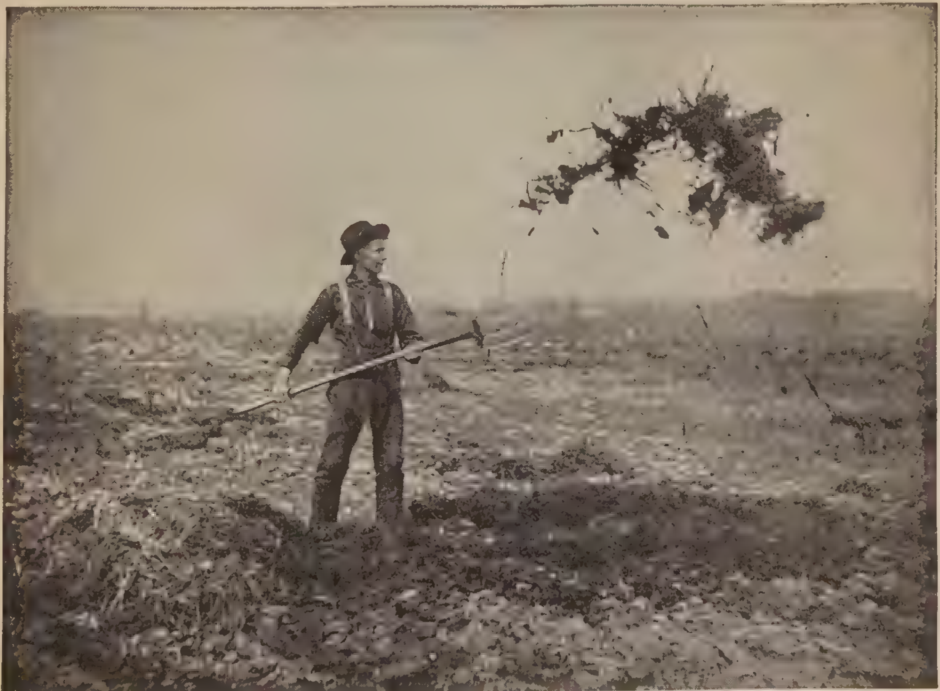
So the great miracles of life and growth go on year after year. The soil, the air and the water give up some of themselves to the growing plant. The plant in turn gives back what it has received. Sometimes it goes back directly, as when the plant itself is buried by the plough. Sometimes the plant may pass into the body of an animal, but this goes back at last, as it has been doing for countless years.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4171.

PREPARING FOR THE YEAR'S HARVEST



In North America is grown a large part of the world's grain, some of which is sent abroad to help feed the nations of Europe. The first step in obtaining this great harvest is to prepare the ground, and here we see manure being scattered evenly over a large field by means of a machine.



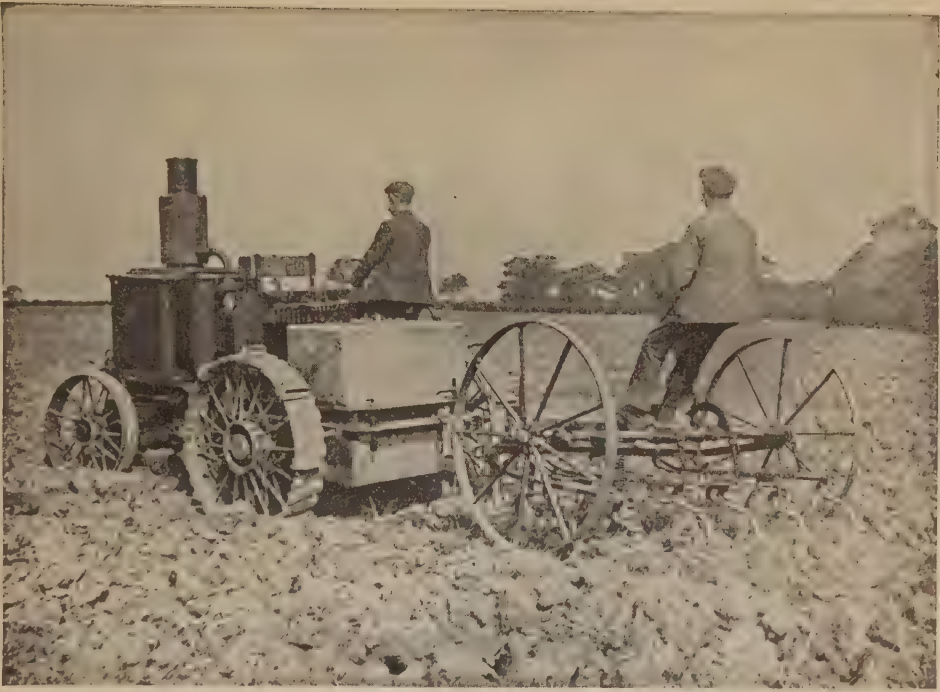
The old-fashioned method is to toss it about with a fork, as we see the man doing in this picture. But the machine does the work better and more quickly. Manuring is really feeding the soil. Science has taught us to make manure from chemicals, but the best food for the ground is the litter from farmyards and stables.

PLOWING WITH HORSES AND MOTOR

Soon after the harvest is gathered, the farmer begins to plough his land for the next, and sights like this are familiar. The plough is guided by the man who holds the handles, and the ploughshare cuts a furrow, and turns the soil over, so that the air, and sun, and rain can act upon it, and buries the grass and stubble.

On large farms other methods are adopted, and a whole row of furrows can be ploughed at once. This is done by using large ploughs fitted with several ploughshares, and in the picture we see two ploughs drawn by a motor-engine and guided by only two men. Eight or more furrows may be cut at the same time.

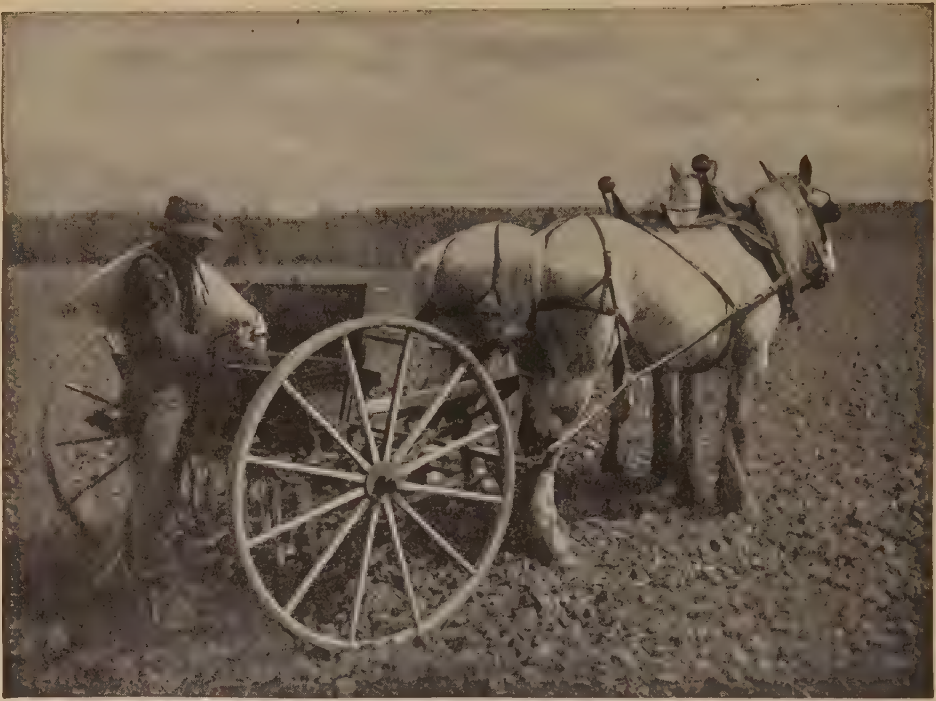
THE OLD STYLE OF SOWING THE SEED



After the land is ploughed, and has been left to the action of the weather for a time, the clods of earth have to be broken up, the soil loosened, and the weeds destroyed. This is done by a machine called a cultivator, which has a number of steel prongs that tear through the ground, and do the work very quickly.

When the ground is quite ready, the seed is sown, and on some farms this is done by hand, just as it was in Bible times when the parable of the Sower was told. In our picture we see a man carrying the seed and casting it from him as he walks up the field. Of course, much of the seed is wasted when sown by hand.

THE NEW STYLE OF SOWING THE SEED



On most farms the sowing is done by machinery, and here we see a machine for drilling and sowing seed being filled with wheat ready for sowing a field. The seed is put into the ground a few inches deep by means of tubes known as shoes, which first of all drill holes for the grain. This method saves time and seed.

It was a long time before seed-sowing machines of this kind could be driven easily and smoothly over the ground as is being done here. The tubes that placed the seed in the soil used to catch in obstacles and stop the machine. But when the tubes were made like shoes, they were able to cut through or rise over obstacles.

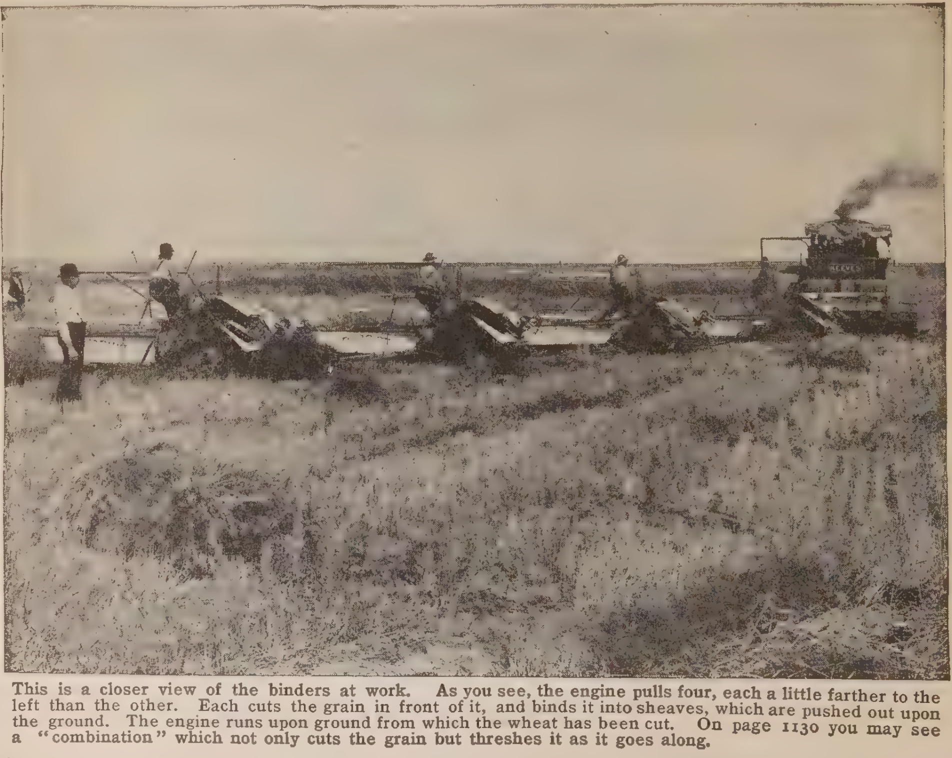
FAIR WAVES THE GOLDEN CORN

Here we see a field of ripe wheat ready to be cut, the result of man's labor combined with the sun and rain. There are few finer sights in Nature than the golden grain rippling and waving as the wind passes over it.

The ripe wheat used to be cut by hand with a sickle; but now a wonderful machine, called a self-binder, is used, which not only cuts it, but binds the wheat into sheaves as the machine moves along. In this picture two self-binders are seen at work in a very large field that would take many days to reap by the old method. Other pictures which show how wheat is grown and prepared for market are on pages 1133-1136.

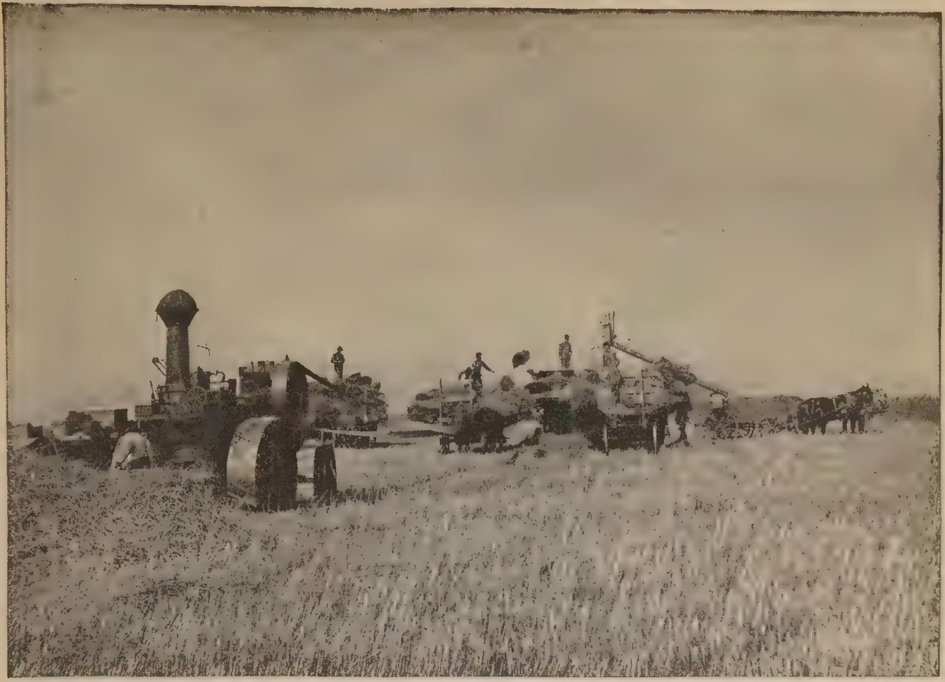
REAPING THE GOLDEN GRAIN IN THE WEST

On a previous page you saw wheat being reaped on an ordinary farm. Here is one of the great wheat fields to be seen in the western part of the United States or Canada. The engine is pulling several reapers, and in the far distance many horses are also at work. The men are stacking the sheaves which have been thrown out by the reapers as they pass along. This field seems to stretch as far as the eye can see.

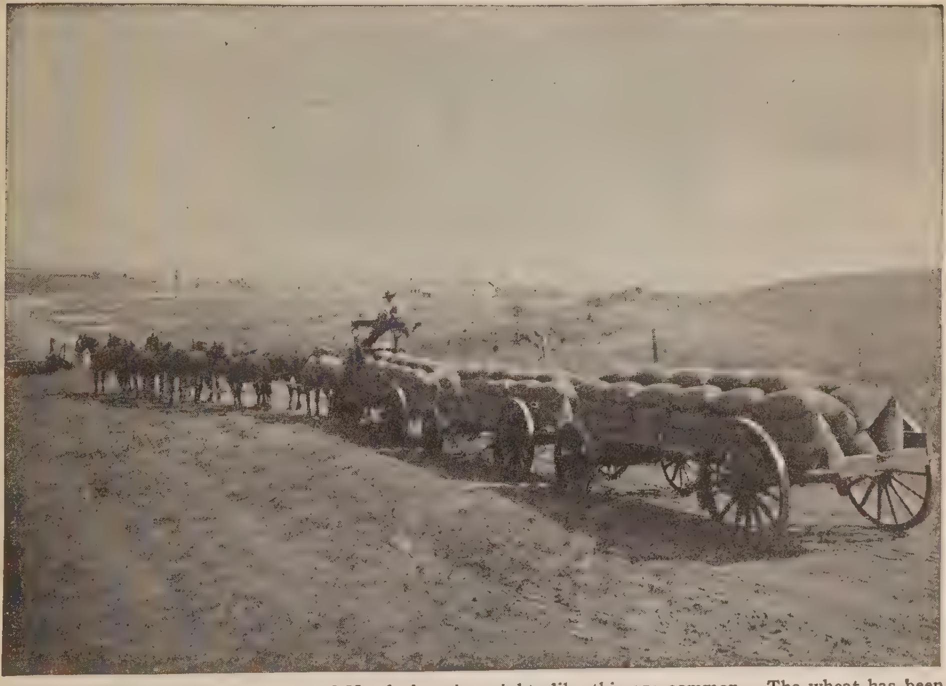


This is a closer view of the binders at work. As you see, the engine pulls four, each a little farther to the left than the other. Each cuts the grain in front of it, and binds it into sheaves, which are pushed out upon the ground. The engine runs upon ground from which the wheat has been cut. On page 1130 you may see a "combination" which not only cuts the grain but threshes it as it goes along.

THE WHEAT STARTS TOWARD THE MARKET



The threshing machine here is nearly surrounded by wagons from which men are tossing the wheat into its throat. Inside, the wheat is separated from the straw and chaff, and pours into the wagon on the right through the pipe you see. The engine which furnishes the power, burns straw, and requires the service of one man to feed it. The wire gauze cap over the smokestack prevents sparks from flying.



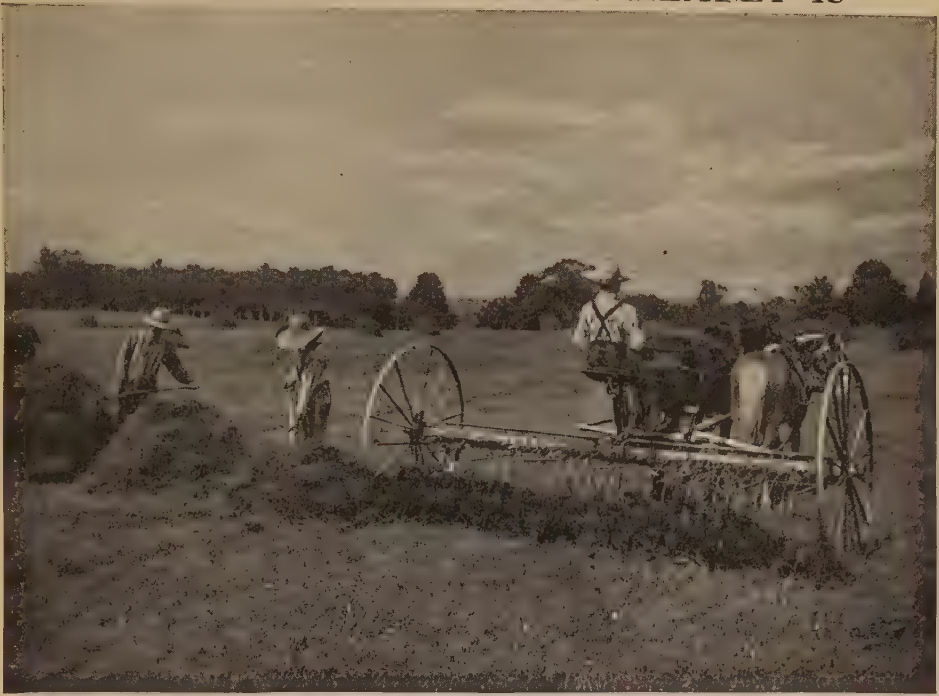
In the great wheat-raising sections of North America, sights like this are common. The wheat has been weighed and the bags sewed up. Horses, or a traction engine, draw it to the railroad. It may be ground into flour there, or may be taken to a mill elsewhere, or perhaps may cross the ocean to feed Europe.
Pictures on pages 4150 and 4151 by Brown Bros.

CUTTING THE HAY FOR THE CATTLE

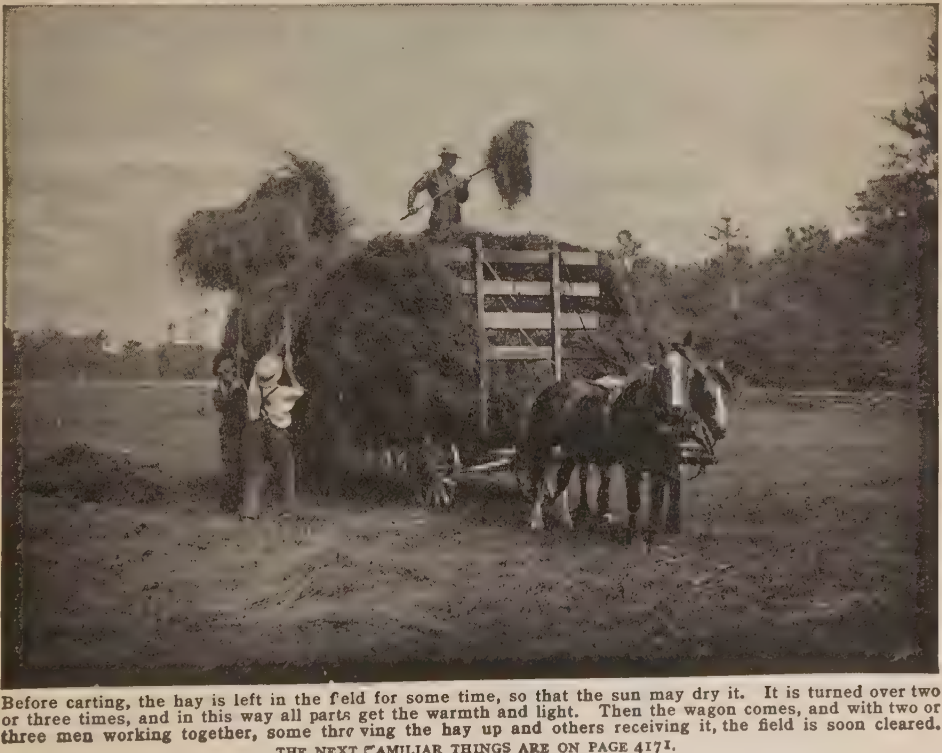
The hay harvest is an important part of the farmer's work. Hay is produced from the grass and mixed herbage of the meadow, and is used as food for horses, cattle, and sheep. It used always to be cut by hand with a scythe and drawn together for carting with a rake, but workers such as these are seldom seen to-day.

A machine like this is called a mower, and it can cut an acre of grass, for hay, in a single hour. It does not do the work so well as men using scythes, but it is so much quicker and cheaper than hand labor that nearly every farmer now uses a machine in his hayfields. Some machines cut a row ten feet wide.

THE HAYMAKING AS IT REALLY IS



Poets, and others, who have written about the country, speak of hay making almost as though it were a nice game in which men and women are laughing all the time. But it is hard work. A horse-rake goes quickly over the field, pulling the hay into rows, and then men with forks make it into heaps ready for carting.



Before carting, the hay is left in the field for some time, so that the sun may dry it. It is turned over two or three times, and in this way all parts get the warmth and light. Then the wagon comes, and with two or three men working together, some throwing the hay up and others receiving it, the field is soon cleared.

THE NEXT FAMILIAR THINGS ARE ON PAGE 4171.

CARLYLE, THE MAN WHO DIGNIFIED WORK

Few thinkers have influenced their age more than Thomas Carlyle, the rugged Scot who roared at the world and denounced hypocrisy. He preached the gospel of work, and some people thought he confounded might with right, but Carlyle always declared that this was the opposite of his teaching. Here we may see the aged "Sage of Chelsea," as Carlyle is often called, on the Thames Embankment near his home.

ADAM SMITH

ROUSSEAU

BURKE

MILL

MAZZINI

RUSKIN

BENTHAM

EMERSON

FAMOUS MODERN THINKERS

ROUSSEAU. BENTHAM. MAZZINI. BURKE. ADAM SMITH. MILL. CARLYLE. EMERSON. RUSKIN.

CONTINUED FROM 4108

THOMAS CARLYLE

ON one occasion when Boswell had returned from abroad, Dr. Johnson said to him in a sarcastic tone: "It seems, sir, you have kept very good company abroad, Rousseau and Wilkes!"

"My dear sir," answered Boswell, "you don't call Rousseau bad company. Do you really think him a bad man?" Johnson replied: "Sir, if you are talking jestingly of this, I don't talk with you. If you mean to be serious, I think him one of the worst of men, a rascal who ought to be hurled out of society, as he has been. Three or four nations have expelled him, and it is a shame that he is protected in this country."

That is one view. Lord Morley gives another: "It was Rousseau who first in our modern time sounded a new trumpet-note for one more of the great battles of humanity. He makes the poor very proud, it was truly said. . . . It was in Rousseau that polite Europe first hearkened to strange voices and faint reverberations from out of the vague and cavernous shadow in which the common people move. . . . The race owes something to one who helped to state the problem, writing up in letters of flame at the brutal feasts of kings and the rich that civilization is as yet only a mockery, and did furthermore inspire a generation of men and women with the stern resolve that they would rather perish than live on in a world where such things can be."

A writer has described a visit to this Jean Jacques Rousseau on the fourth floor of a house in Paris: "We passed through a very small antechamber, where the household utensils were neatly arranged, and from that into a room where Jean Jacques was seated in an overcoat and a white cap, busy copying out music.

"He rose with a smiling face, offered us chairs, and resumed his work, at the same time taking a part in conversation. . . . Near him was a spinet, on which from time to time he tried an air. Two little beds of blue and white striped calico, a table, and a few chairs, made the stock of his furniture. . . His wife was sitting mending linen; a canary sang in a cage hung from the ceiling; sparrows came for crumbs on to the sills of the windows which on the side of the street were open; while in the window of the antechamber we noticed boxes and pots filled with such plants as it pleases Nature to sow. There was in the whole effect of this little establishment an air of cleanness, peace, and simplicity which was delightful."

Two swallows built their nest in Rousseau's bedroom, and there hatched out their brood.

"I was no more than a door-keeper for them" he said, "for I kept opening the window for them every moment."

They used to keep on flying round about his head with a great stir until he had fulfilled this humble duty.

ROUSSEAU, THE STRANGE, BAD MAN WHO WAS GOOD TO THE POOR

Now, you will think that Dr. Johnson exaggerated when he said that Rousseau ought to be transported. But the truth is that Rousseau is one of those strange men about whom it is possible to hold two opinions, and those the most contradictory. Lord Morley, in his great book on Rousseau, quoted a verse of Victor Hugo's, which likens the soul of a man to a pool; in the still water is mirrored the sky tinged with heaven's fire, and beneath is the loathsome slime, where black and shadowy reptiles creep dimly through the dark. Such was Rousseau's soul.

Rousseau was an angel of light to the poor. He saw a world where men suffered, women grew spiritless, and children went hungry, cold, and ignorant; and where those who sought to make things better got lost in a maze of words. To Rousseau it seemed that one thing only was necessary—*to simplify.*

He wanted to simplify religion, so that all men might share its comfort; to simplify social relations by making all men equal; to simplify manners by homeliness and thrift; and to simplify literature and art, and life in general, by what he described as "a return to Nature"—that is to say, by constantly referring ourselves to Nature itself instead of to society and books.

THE MAN WHO SOWED THE SEEDS OF THE FRENCH REVOLUTION

He was stung by pain and suffering as Dr. Johnson could never be. "Worn-out horses," he exclaimed, "ready to expire under the blows they receive; wretched peasants, attenuated by hunger, broken by weariness, clad in rags; hamlets all in ruins—these things offer a mournful spectacle to the eye; one is almost sorry to be a man, as we think of the unhappy creatures on whose blood we have to feed.'' But if Rousseau felt these things more keenly than Dr. Johnson, he did not possess that great man's solid and lasting commonsense. Dr. Johnson was a good man. Rousseau was a bad one. To tell Rousseau's story, even in brief, would be to shock and disgust us. It is enough to know that the later years of his life were spent in some form of madness, the seeds of which were probably growing all through his youth and manhood.

We cannot explain these things. The great and virtuous Dr. Johnson never altered one cruel, wicked, or tyrannous injustice. Rousseau expressed the indignation of men and women against all these things. He helped the poor to gain self-respect, and perhaps did more than anyone else to aid the growth of the French Revolution, the great movement which altered the whole system of government in France.

THE GREAT WATCHWORD THAT JEREMY BENTHAM GAVE THE PEOPLE

He who invents a great phrase does more than preach a sermon, for a phrase that sticks in the mind is like a lever thrust under the thoughts of men in order to turn them into a fresh channel. The older we grow the more we shall see how mighty a thing it is to change men's opinions. Every man clings to his own ideas. Outside the radius of his own light all is darkness. And this darkness is not illuminated by long books and speeches glowing with fine words. It yields before the flash of a pithy sentence.

To Jeremy Bentham belongs the honor of turning men's minds in a new direction; and this he did by a single phrase. While but a few pored over his long books, the soul of Europe seized upon one single sentence therein and flashed it like a torch into the darkness that surrounded them.

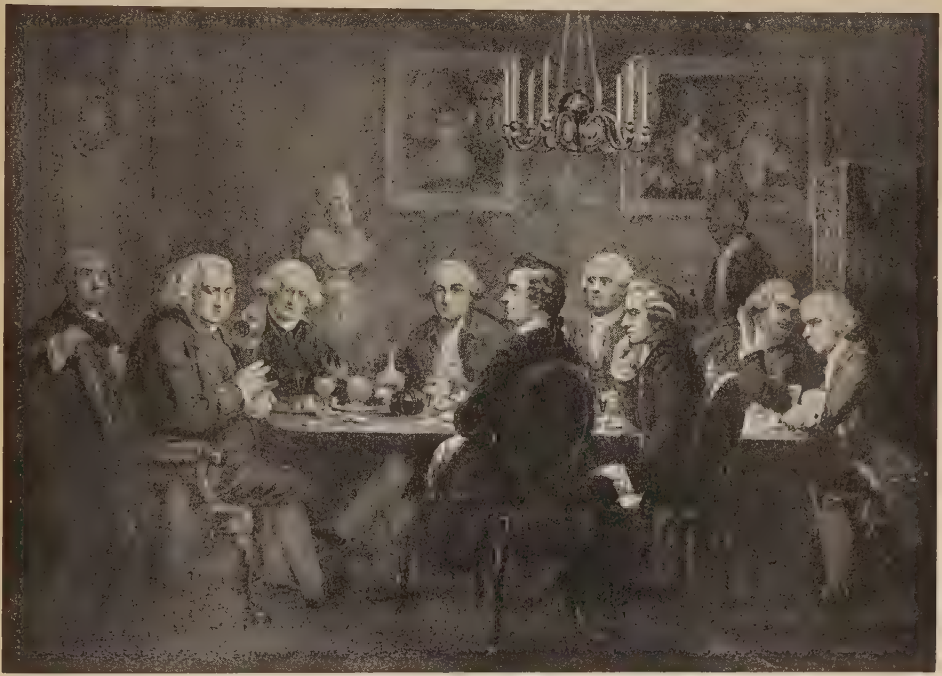
This phrase was not strictly his own, but he it was who made it live. It runs simply enough: "The greatest happiness of the greatest number." Bentham wanted to find a reason for things—a reason for morality and a reason for law; he discovered it in this simple phrase. The object of morality and the object of law is the greatest happiness of the greatest number.

Before his day men thought loosely about such subjects. Law was to punish crime. Morality was what the priest ordained. Bentham revealed deeper foundations. Law did not exist to protect the rich man's purse from the thief, but to secure the freedom and happiness of all men. Morality was not born out of the clouds; it was man's own discovery for the blessing and advance of the human race. All the efforts of government justified themselves only if they aimed to secure the greatest happiness of the greatest number. Does not this seem simple to us, and striking? Even now happiness is regarded by many people as the exclusive property of the few.

But before Bentham's day the masses of people in the world were almost resigned to the idea that only the rich could be happy, and that it was to protect the rich that there were laws and morality. Jeremy Bentham developed the splendid thought of Bacon that philosophy must be the servant of humanity. He invented the word *utilitarian* to describe the only philosophy that was worth while, a philosophy that was useful to the human race. He did not believe in dreaming of ideas. He wanted philosophers to show the human race—the greatest number of the human race—how to be happy.

There are faults in the details of Bentham's theory. Some object to its main idea. We should have to agree first in what happiness consists before we could march forward. And we should have to remind ourselves of Bacon's noble saying, "Prosperity doth best discover vice, but adversity doth best discover virtue," before we could be certain of our goal. Nevertheless, our debt to Bentham is a great one, for he established both law and morality on a sure foundation at a time when men, ill-educated and made hasty and reckless by suffering, were inclined to hurry all such things to the fire of destruction.

And Bentham also gave to men the Christlike principle that they should consider the happiness of other people before everything else. If every politician, preacher, writer, and private person truly sought the greatest happiness of the greatest number, we should be within sight of the Golden Age.



A party of famous men at the house of Sir Joshua Reynolds, the first president of the Royal Academy. Reading from the left hand the names are James Boswell, Dr. Johnson, Sir Joshua Reynolds, David Garrick, Edmund Burke, Charles Burney, Paoli, the Corsican patriot, Thomas Warton, and Oliver Goldsmith.

Bentham was the son of a rich man, and was born, very weakly of body, in Houndsditch, London, in 1748. He read history when he was three years of age, and at the same time began to learn Latin. At six he was playing the violin, and he matriculated at Oxford when he was only thirteen. He loved music to the end of his days, and kept a piano in every room of his house. He was fond of flowers and had many shady walks in his London garden. He was modest, hospitable, and simple in his conversation. He died aged eighty-four. His body was dissected—as he had instructed—and, after being embalmed and dressed in his usual garments, it was set up in University College, London.

Room must be found in this brief chronicle of great thinkers for the noble-minded patriot of Italy, Joseph Mazzini. He was a man who loved Italy above everything else on this earth, and God above everything else in the universe.

JOSEPH MAZZINI, THE PATRIOT THINKER OF ITALY

He spent his life in exile, was imprisoned, was banished from country after country, and for many years lay under sentence of death. But his faith never wavered. At the dawn of his manhood he founded a society called Young Italy, which was to work for the freedom of the country, then oppressed by foreign tyranny and torn by quarrels within itself. The motto of this society was "God and the People"; on its banner were the words "Unity," "Independence," "Liberty," "Equality," and "Humanity." From these ideals he never swerved.

His call came to him as he lay in prison. Looking out from his cell, he could see the sky and the sea. "Symbols of the Infinite" he called them. His only companion was a greenfinch; his only books were a "Tacitus, a Byron, and a Bible." In these circumstances it was that the call came to him, "God and the People."

The great work which he did as a patriot of Italy belongs to the world. His patriotism ennobled humanity. Every nation has been the better for his life. Mazzini was one of those great souls who recognize God in politics. He did not seek to make the Italians free only that they might earn more wages and work fewer hours; he preached to them a lofty gospel of duty to God and man; he set virtue always before their eyes. The mere political agitator, who sets class against class, would have felt the lash of Mazzini, who loved the common people because he always believed them to be the children of God.

EDMUND BURKE, WHO MADE MEN SEE THE PRINCIPLES THAT MOVED THEM

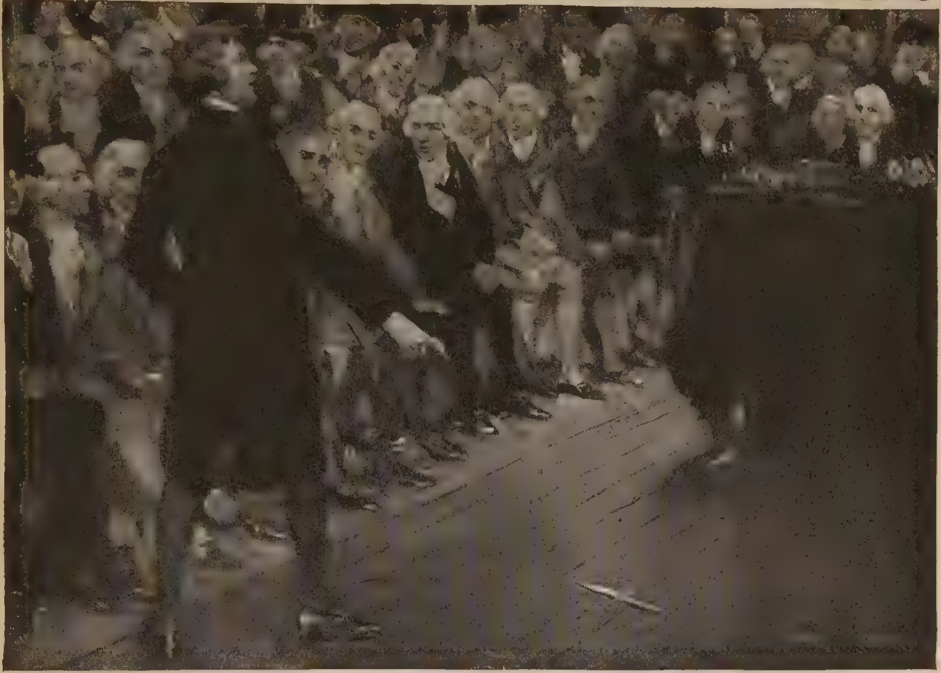
If we heard someone praising Edmund Burke, and asked what it was he did to deserve praise, the admirer of Burke would not be able to point to any definite achievement. He would not be able to say that Burke conquered this or that country, nor that Burke tore down a tyrant from a throne, nor that he wrote a book which has been the comfort and consolation of unhappy men. And yet the name of Edmund Burke remains one of the very greatest in the history of the world. He was only a voice, but a voice of power.

It has been finely said of him that he made great tides in human destiny very luminous. This meant that he could make men see the current of principle which carried them forward, make them aware of the reasons which moved them. The work of the great thinker is that of the interpreter. He interprets into human language the deep and obscure feelings of the soul. We know that we are often carried away by feelings, that we are often driven to do things without knowing why; it is the same with all men and women, and with nations. We are all conscious of being swept into certain actions, or of being intensely occupied by certain notions and ideas; but we cannot explain in simple language what it is that moves us.

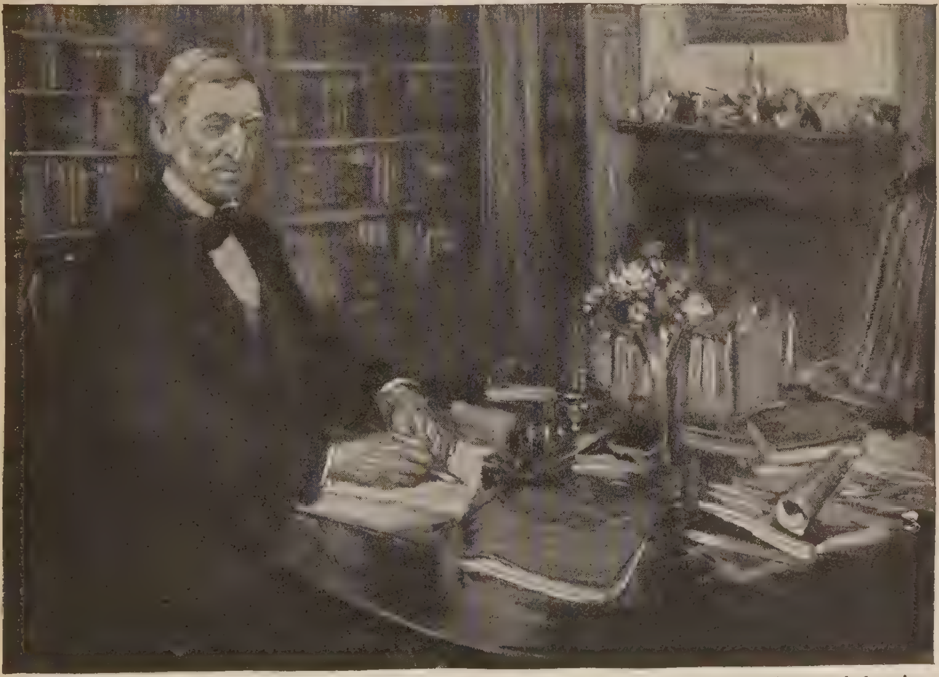
HOW BURKE STOOD FOR FREEDOM AND HONOR AMONG THE BRITISH PEOPLE

Burke was one of the great interpreters of justice, freedom, and morality. The work of which he was proudest was the spirit of justice, freedom, and morality which he breathed into the government of India. He attacked before the whole world a great Englishman, Warren Hastings, for misconduct in India. This impeachment in itself was a small matter; the great result of it was that the whole of England realized its responsibilities in India for the first time. Burke made Englishmen feel the glory of freedom, the honor of justice,

BURKE SPEAKING AND EMERSON WRITING



Edmund Burke was a great political thinker. He believed in steady progress, but never ceased to denounce the French Revolution. The famous dagger scene in Parliament has become historic. Declaring that daggers were being made at Birmingham, he hurled one upon the floor of the House of Commons, exclaiming: " That is what you are to gain by an alliance with France." He was much laughed at for this action.



Ralph Waldo Emerson, the American poet and essayist, was one of the most original thinkers of the nineteenth century. He taught that the soul of man is the master of the intellect and the will, and by its illumination man can interpret the mysteries of Nature. A man of sweet and gentle character, he lived simply and quietly, and here we see him in his study, which was not only the study of a scholar, but the bower of a poet.

and the eternal necessity for morality. Ever since his day England has endeavored to govern her vast empire, not as something to make her rich, but as something for which she is responsible to God and humanity.

THE IRISHMAN WHOSE VOICE MOVED ALL EUROPE

Burke stood for the honor of the English nation when George III. would have taken away their privileges, and made himself an autocrat. Burke was on the side of France in the Revolution, till the justice of that movement clad itself in the murderer's dress and built its walls of freedom in the blood and agony of despotism. He was ever on the side of justice and freedom, but it was as a man conscious of righteousness.

Although he practically swayed Europe with his voice, he had no place of power in England. When Windham received one of his greatest books, he wrote in his diary: "What shall be said of the state of things, when it is remembered that the writer is a man decried, persecuted, and proscribed; not being much valued even by his own party, and by half the nation considered as little better than an ingenious madman?" Oliver Goldsmith made a mocking epitaph upon him:

Here lies our good Edmund, whose genius was such,
We scarcely can praise it or blame it too much;
Who, born for the universe, narrowed his mind,
And to party gave up what was meant for mankind.

Dr. Johnson said that you could not meet Burke for half an hour under a shed without saying that he was an extraordinary man. It is curious to relate that, at the end of his day, the king was going to make him a peer, with the title of Lord Beaconsfield. Before this happened Burke lost his only son, who was a foolish fellow. But this son was loved passionately by his father, who sank under the loss.

THE STORM OF SORROW THAT BOWED DOWN A STRONG MAN

"The storm has gone over me," he wrote, "and I lie like one of those old oaks which the late hurricane has scattered about me. I am stripped of all my honors; I am torn up by the roots and lie prostrate on the earth. I am alone. I greatly deceive myself, if in this hard season I would give a peck of refuse of wheat for all that is called fame and honor in the world."

One of his wisest sayings about government was: "The question with me is not whether you have a right to render your people miserable, but whether it is not your interest to make them happy."

This wonderful man was born in Ireland, and made his way in the world with no interest of any kind. His father refused to help him because he would not follow the law as a profession. By his own splendid powers, his devotion to work, and his faith in the justice of his cause, he rose to have a strong influence over all Europe.

ADAM SMITH, THE SIMPLE MAN WHOSE BOOK GAVE MEN NEW IDEAS

Adam Smith, a great writer on political problems, was a Scotsman, who was born on the 5th of June 1723. He was a great thinker, and one of his books, called "The Wealth of Nations," altered the ideas of men both in Europe and America.

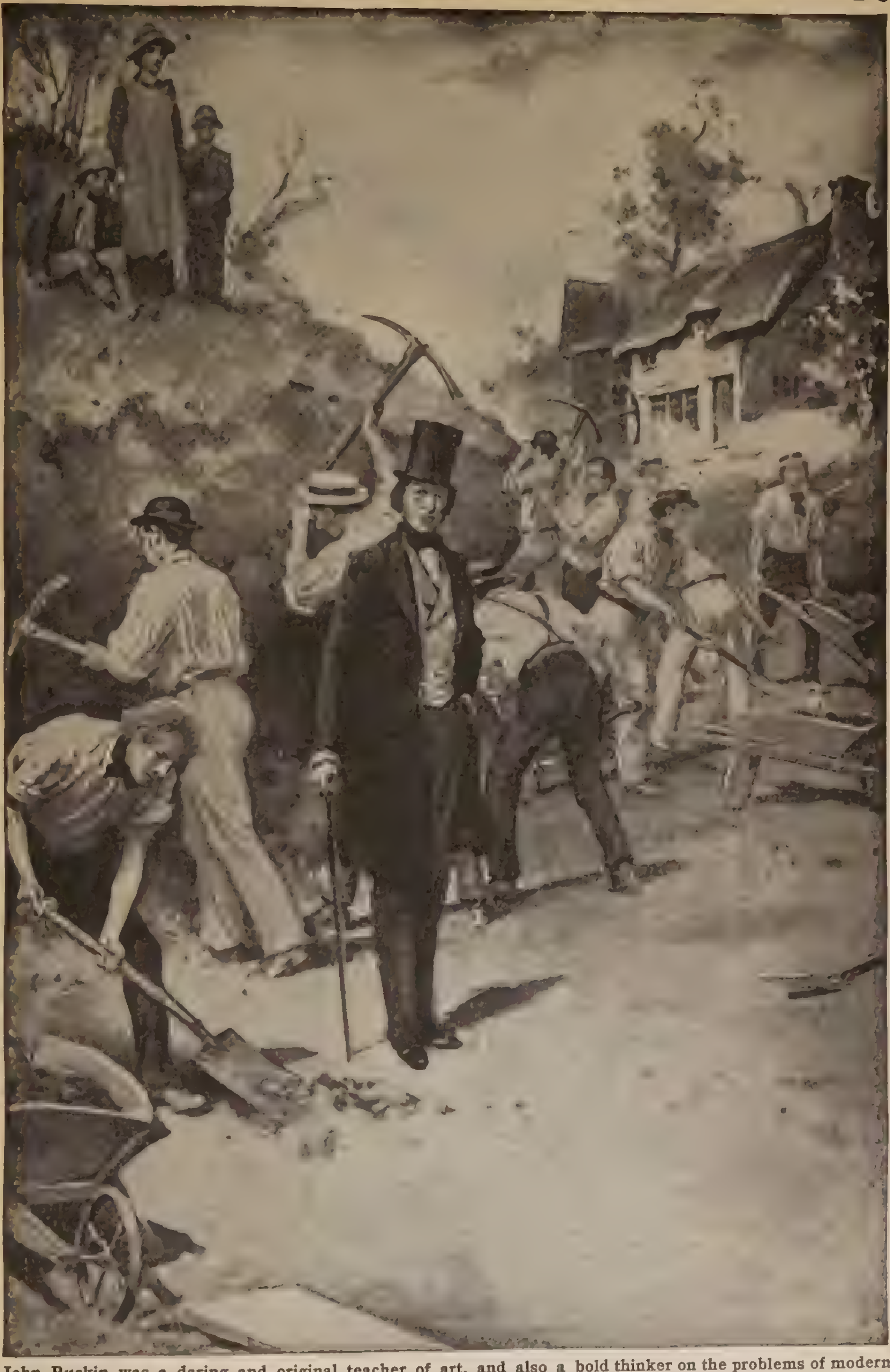
He was devoted to the working class, and was suspicious of tradesmen, merchants, and manufacturers.

"It is but equity," he says, "that those who feed, clothe, and lodge the whole body of the people should have such a share of the produce of their own labor as to be themselves tolerably well fed, clothed, and lodged." Also: "Our merchants and manufacturers complain much of the effect of high wages in raising the price, and thereby lessening the sale, of their goods both at home and abroad; they say nothing concerning the bad effects of high profits; they are silent with respect to the pernicious effects of their own gains; they complain only of those of other people."

This great and good man received honors on every hand, and retained his simple, modest, and useful habits to the end of his life, in 1790. He was a friend of Hume, the historian, and was known to the first minds in France. He became Lord Rector of Glasgow University.

John Stuart Mill was a man whose life will always remain one of the most interesting in human chronicles. His father, the son of a Scottish shoemaker, had raised himself by sheer force of literary industry to a position of importance in London. He had original

HOW JOHN RUSKIN TAUGHT HIS STUDENTS



John Ruskin was a daring and original teacher of art, and also a bold thinker on the problems of modern life. Although his views were often laughed at, it is now generally recognized that much of his teaching was right. While a professor at Oxford, Mr. Ruskin took his students out to break stones and make up the roads, in order to impress upon them the dignity of labor and to improve the appearance of the country.

ideas about things, and did not believe in schools. He educated his young son himself, and at three years of age John was learning the Greek language. The boy grew up in the companionship of this earnest father, and early in youth manifested singular powers.

THE SUDDEN THOUGHT THAT CAME TO JOHN STUART MILL

He was a man before he was a boy, and could hardly remember the time when he did not think. He received his "call" from reading a French translation of a work by Bentham. He set himself with enthusiasm to see the way which led to the greatest happiness of the greatest number. He wanted to make life happier and nobler, and he saw that the way out of misery could only be found by resolute thinking.

While he was striving with great enthusiasm for this grand object, a sudden chill struck through his soul. His soul asked the question: Suppose that all your objects in life were realized, that all the changes in institutions and opinions which you are now looking forward to could be completely effected at this very instant, would this be a great joy and happiness to you? He saw that this happiness lay in working for the grand end, not in the end itself. "I seemed," he said, "to have nothing left to live for."

So it must be with all philosophers and politicians who do not see that progress is infinite and eternal; that there cannot be any *end* at all, because man is immortal.

Mill found his work in seeking how to guard democracy from self-destruction. Many people thought that if workmen were given a vote the empire would fall to pieces, religion would be trampled underfoot, and the race of Englishmen would perish in sin. Mill did not think the danger was so great; but he certainly felt that something should be done to teach workmen, and, indeed, all kinds and conditions of men, that life was a serious and delicate experiment.

THE PLAIN PHILOSOPHER WHO MADE THE MULTITUDE THINK

The shouter at a street corner often knows nothing of history; he cares little what he says; he handles life as if it were a box of bricks. Mill saw that all men accepted the ruling of great men in the matter of science, and he thought it should be possible to form a science of politics, the masters of which would tell democracy what was right and what was wrong in the ideas of politicians. He wanted certainty.

All his chief work was in this direction. He failed; but it was a failure which is better than many victories. There can never be certainty in opinions, and politics is largely a matter of opinions. Mill, however, has taught men to be careful how they think, and still more careful how they speak. He has shown us the danger of words, and made us steady workers for change, instead of violent, hot-headed revolutionists. More than this, he set people thinking who had never thought before, and to those who did think he brought more subjects for their thoughts, and fresh ideas for their illumination. He was one of those quiet and self-contained philosophers who effect great reformations by making the multitude think.

THOMAS CARLYLE, THE SCOTSMAN WHO ROARED AT THE WORLD

A very different man from Mill was his friend, Thomas Carlyle. Carlyle had no lack of confidence in himself, no hesitancy about speaking. He opened his mouth and roared at the world. He was sure that what he had to say was the only thing worth saying, and, accordingly, he said it with energy.

Carlyle's gospel was the gospel of great men. The workman, armed with a vote and become master of the British Empire, was bid by this big-hearted Scotsman to study great men, to listen to the heroes, to bow before the divinities of the human race. While Mill was seeking, with laborious care, for certainty, Carlyle was shouting to the world that salvation lay in the worship of great men. He felt that he had read the riddle of the Sphinx.

There is much excellent truth in Carlyle. Huxley, the man of science, said that Carlyle's writings had saved him from becoming an idle and light-minded man, had made him earnest. But Carlyle rather overdid his gospel, for he preached energy to one of the most energetic nations on the face of the earth. He did not see the necessity for bringing home to men the need for modesty, gentleness, refinement, spirituality. He shouted, "Work!" to a working world. He preached the very thing that tends to increase riches without destroying ignorance. But his influence for good was enormous. Carlyle is like some Old Testament prophet. His words burn and glow. His face seems to shine with the light of God. His was a voice raised up for eternity and immortality, at a time when men were losing faith in their high destiny. We cannot read him without feeling the spell of his words. He was full of a noble fervor. His soul was sure of God.

THE TERRIBLE MISTAKE OF A SERVANT AND THE HEROISM OF CARLYLE

There was one story about him which shows his courage. He had written the "History of the French Revolution," an immense work, and lent the manuscript to his friend Mill. By some terrible mistake this precious manuscript was burned by a maid in Mill's household. With this great misfortune all the toil and labor of years vanished in smoke up the chimney. When Carlyle heard it, he sat down and read Marryat's novels for a week, then he set to and re-wrote the History. Probably no other writer has ever had such a task to face.

His life was a long martyrdom to indigestion. His temperament was affected by this trouble, and he was not always as kind to his beautiful and brilliant wife as he might have been. She died in her carriage as she was driving round Hyde Park, after having received a telegram telling her of some great success of Carlyle in Scotland. Her death broke his heart. Filled with sorrow for his harsh treatment, he spent his last years in mourning for this lovely woman, whom death had taken from him. His last years, if not his whole life, were a tragedy. But his works live, and men will feel the power of his mind for many generations.

EMERSON, THE SMILING PHILOSOPHER, WHOSE FAITH WAS IN THE SOUL

Ralph Waldo Emerson, the American essayist, believed, like Carlyle, in the uses of great men. "The race goes with us on their credit. The knowledge that in the city is a man who invented the railroad raises the credit of all the citizens. But enormous populations, if they be beggars, are disgusting, like moving cheese, like hills of ants, or of fleas—the more the worse." Emerson began life as a minister of the Unitarian Church. This church believes in one God, and declares that Jesus is the supreme human Authority. Emerson believed passionately in one God. He remained to the end of his days a devout admirer of the character of Jesus, but he could not feel that Jesus was the only and supreme Authority. He taught that a man's own soul was the chief revelation of God. Soon, therefore, it became necessary for him to leave his church, and he turned to literature and lecturing for a livelihood.

His face is described as "radiant" and "angelic"; his voice was full of beauty and intensest music. Such a lecturer soon had the world at his feet. "Emerson," says one writer, "was a sweet-tempered Carlyle, living in the sunshine; Carlyle was a militant Emerson, moving amid thunder-clouds." Both believed ardently in a spiritual destiny for man; both felt with glowing fervor the glory and satisfaction of God. While Carlyle declaimed, Emerson smiled. Emerson had the beauty of a tranquil faith, and the composure of a soul that was deeply touched by the sense of eternity.

THE TEACHING OF RALPH WALDO EMERSON AND JOHN RUSKIN

The saying of Emerson, "Heroism feels and never reasons, and therefore is always right," expresses almost the soul of his teaching. He taught that no man can think or reason his way to the truth of the infinite universe. A good man, a pure man, whose soul is set to catch the splendor of God's power, will, on the other hand, find himself moved and influenced by the truth. "All goes to show," he wrote, "that the soul in man is not an organ, but animates and exercises all the organs; is not a function like the power of memory, of calculation, of comparison, but uses these as hands and feet; is not a faculty, but a light; is not the intellect or the will, but the master of the intellect and the will." His great faith was in the soul.

One of Emerson's most beautiful essays counsels men to follow the instruction of Jesus concerning prayer. "If he would know what the great God speaketh, he must go into his closet and shut the door," as Jesus said. God will not make Himself manifest to cowards. He must greatly listen to himself, withdrawing himself from all the accents of other men's devotion. Even their prayers are hurtful to him, until he have made his own. This was his teaching; the direct relation between a man's soul and the God of the Universe. He inspired men to feel at home in the Infinite. He made them feel, too, that vice and cruelty and wickedness were base things, unworthy of them. Many people, of course, find fault with Emerson's opinions, but he remains head and shoulders above all other great moralists and essayists produced by America.

John Ruskin, the son of an English wine merchant, besides being a capable man of business, was fond of pictures, statues, and fine buildings. Mrs. Ruskin was a handsome woman, very severe in her ideas, ungracious in her manner, but entirely excellent in devotion to duty. The little son of these parents had a strange infancy; his body, his brain, and his soul were watched over with an unceasing anxiety; he was not allowed to play with toys; his intellect was trained from the very first to observe Nature and reflect upon what he saw; many times he was whipped as a boy.

The study at the top of his house in Chelsea, where Carlyle used to escape from the noise of the hawkers in the streets.

Thus trained, he grew to be extraordinarily clever, particularly in all matters relating to art. He became an enthusiastic worshipper of great buildings and noble pictures. He conceived the theory that buildings and pictures are the outward and visible signs of a nation's inward and spiritual feelings; buildings and pictures *express* a nation's religious feelings. His books on these subjects made him famous while he was still young.

Then came the natural next step. From the glorious buildings of the past he turned to those of the present—to the factory town, with its hideous chimneys, its blackened walls, its dreary streets of unmingled ugliness; and he condemned the whole system which could produce such a state of things. He attacked men of science and politicians; he said that they were wrong; he denounced their philosophers, and derided their "laws of economy." It was enough for him that modern life wore a sooty coat and went on broken boots. He wanted sun, rose-colored clouds, green pastures, and palaces of stone. He condemned the world.

But when with lavish generosity he himself endeavored to set up model factories, the efforts proved a sad failure. No, not a failure; there is no failure in the work of a true soul. Although the co-operative and socialistic attempt at a model industry came to an end, the idea lived, lives now, gathers in force, and it may at some time rule the world. For man does not live by bread alone. As the race advances, it feels how unsatisfying are the mere wages of labor. Each generation, a little better educated than the last, feels itself carried forward to a goal more honorable than that which satisfied the past. Beauty becomes a religion. Ugliness wears the look of sin. This was Ruskin's work. It may be regarded as in some ways the greatest work of modern times. His long life was loyally spent in bringing home to the business and bosoms of men the thought of beauty—beauty in buildings, in paintings, in vesture, in manners, in conduct. Ruskin's fight for this object was a strenuous one. The forces against him were enormous—the forces of mammon, prejudice, and ignorance. But he neither stumbled nor quailed. His gospel has spread to other nations; his ideas are growing in the minds of every class. We cannot doubt that the present system, which makes life so hideous and dull, will pass utterly away and Ruskin's gospel of beauty become part of the religion of humanity.

THE NEXT STORIES OF MEN AND WOMEN ARE ON PAGE 4215.

A Canoe and Totem Poles from Alaska

THE MOST NORTHERN TERRITORY

PEOPLE of warmer climes sometimes think of Alaska as a raw, rough country, a country of rugged mountains and barren snow-covered plains, a country of short summers and bitter winters, a country with little pleasure and abounding peril. Some novelists have written as though all the men were creatures of the wild, with primitive wants and passions,—savage creatures with savage loves and hates, whose lives were a perpetual struggle with cold, and hunger. This is not the real Alaska, of which we shall try to tell you something.

WHERE THE STORY OF ALASKA REALLY BEGINS

Through the first years of Alaska's history, no one even guessed the riches that lay buried in the heart of this great white land of the North. The story of Alaska really begins with the days of Peter the Great of Russia. It was a time of great excitement throughout Europe, for Guillaume de Lisele, First Geographer to the King of France, had just given to the world a new map showing a great unexplored country between Asia and America. It was reported that this land was one of fabulous wealth, a veritable Eldorado. France and Spain at once sent ships sailing over the seas to explore and claim the new country for their respective sovereigns.

Wonderful tales of the northwestern land drifted to the ears of Peter, Czar of Russia, and he too resolved to add it to his empire. He planned an expedition in charge of Vitus Bering, a Danish navigator, in his service. It failed so completely that Bering returned to Russia convinced that "though there was such a country on the maps, there was none in the sea." But the wise Peter and his councillors would not listen to Bering, but persisted in sending him out for another trial.

In 1741, Bering sailed once more. For days at a time he was enveloped in an impenetrable fog, and at last he gave up hope and ordered his ship to turn its head homeward. As he did so, behold! the fog lifted and driftwood and seaweed and birds appeared, and before them lay a great land, and a great peak lifted its giant head into the clouds. And because it

Copyright, 1911, 1918, by M. Perry Mills.

was St. Elias' day, they called the peak Mount St. Elias. Bering himself was wrecked, and no white settlement was made for more than forty years.

THE PURCHASE OF ALASKA BY THE UNITED STATES

The land seemed bleak and bare, with but few natural resources. A few fur traders wandered over the waste, and Sitka was for a while a considerable town, but furs became scarcer. Finally, Russia needed money, and, in 1867, sold this great tract of wilderness to the United States for the sum of $7,200,000. This purchase caused a great deal of excitement, and it was the general verdict throughout North America that the government of the United States had done a very foolish thing. It seemed sheer "wasteful extravagance to pay $7,000,000 for miles of icebergs and polar bears."

For a time the country was occupied by United States soldiers, but there was nothing for them to do, and a naval officer governed the country. He was withdrawn, and for years there was no government at all, except the tribal customs of the Eskimos and Indians, who were thinly scattered over the land. In 1884, Congress gave the president power to appoint a governor, but did not trouble to make laws for the country. The laws of Oregon were declared to be in force so far as they were suitable.

GOLD DRAWS MEN TO THE NEGLECTED TERRITORY

Though it was known that there was gold in Alaska, not much attention was paid to the fact, though in 1895 hundreds of men were engaged in mining, and one or two of the mines produced large quantities of the precious metal. In 1896, rich placer deposits were discovered in the Klondike, near the boundary, but on the Canadian side of the line. Placer mining means that free gold is scattered through the soil, and as the soil washes into the streams, much of it sinks to the bottom and remains in the sand. A man does not need any expensive machinery to get it out, but uses the pan, which has been described elsewhere.

Thousands rushed to the Klondike, and swarmed over on the American side, but did not find much gold until 1899. Then even richer deposits were found around Nome, on the western coast. Many other fields were discovered, and every boat that could float carried eager seekers for gold to the north. Some men were wonderfully successful. As the result of a single week's work a man might get thousands of dollars. Men went mad and fought for claims which showed good prospects, but some found no gold at all. Deep mines were opened, and more and more of the gold comes from them. Since 1910, about $16,000,000 a year has come from the country that was bought for less than half that sum.

Gold is found in almost every corner of Alaska, but the individual owners are losing their grasp, and the mountains and rivers are being worked by large corporations with ample capital to install expensive machinery. "The day of bucket and windlass has passed for the Klondike. Dredging and hydraulicking have taken their place, and the trains and steamers are loaded with powerful machinery to be operated by vast corporations."

MANY NATURAL RESOURCES BESIDES GOLD ARE PRESENT

Gold is not the only mineral found in Alaska. Copper mining began in 1901, and since that time other deposits have been found, and now there are several smelters in operation. While not so large as the production in some other regions, the value of the copper produced is large and is increasing. Some day much more may be extracted than at present, as there seems to be almost an unlimited supply of the metal.

There are vast fields of coal in Alaska, but they have not been worked very much. Some of the coal is good, but much is rather low grade. Coal is so heavy in proportion to its value that the coal fields will not be worked until more railroads are built so that it can be moved more cheaply.

Tin is found, and there is some petroleum, though how much is not known. Some good marble is found, and some gypsum also. Small quantities of other minerals have been found. The truth is that the country has never been really explored, and we do not yet know how valuable the minerals are. Some men think that Alaska will, one day, be one of the chief mining districts of the world.

GARDENS AND FORESTS AT THE EDGES OF GLACIERS

Agriculture, too, has been found to be very profitable in the southeastern

IN THE FAR NORTHLAND

Here is a picture of Sitka, the old capital of Alaska. Years ago it was the seat of the Russian governor, then it was the headquarters of the United States authorities. It is a sleepy, conservative old town, untouched by the bustle and activity that characterize the towns that have sprung up so quickly in the rush for gold. Though founded in 1799, the population in 1910 was only a little more than one thousand.

In Alaska the steamers must sail south before the long winter sets in or the chances are that they will be caught and held fast in the ice-locked waters of the northern seas. Here we see a tourist steamer making its way through the Takou Inlet to the Takou Glacier. It has been surrounded by floating cakes of ice and needs all the force of its powerful engines to push its way through the freezing waters.

portion of Alaska. Potatoes, cabbages, turnips, cauliflowers, beets, etc., grow to an enormous size in the short Alaskan summer. Like mushrooms they seem verily to spring up over night. It is one of the wonderful things of this northland that wild currants, blueberries, raspberries and luscious strawberries can be found growing in sheltered nooks under the very shadows of the glaciers, though some complain that they are too watery.

There are no large farms, for labor is very expensive, and many kinds of food can be brought from the United States more cheaply than they are raised, but the excellent market for fruits and vegetables makes market gardening very profitable. Some of the land produces excellent grass, and cattle and sheep are being raised. As the population increases, the amount of land cultivated will increase also. The United States has established experiment stations to find out what crops can be best grown.

There is much timber in Alaska. Hemlock, spruce and cedars are very common in some parts, and there are also poplar, aspen and birch. In some parts the trees do not grow large, but there are thousands of acres which can be used for paper-making. Some of the plains are treeless, but everywhere the wild flowers are many and beautiful.

FISH AND FURS ARE BOTH IMPORTANT

Many excellent food fish are found in Alaskan waters. The salmon is most important, and there are dozens of canneries which preserve the fish for export to all parts of the world. Several kinds are found in countless numbers, and some of them are smoked and dried instead of being placed in cans. Cod, halibut and herring are also caught. Though the whale is not a fish, we often speak of the whaling industry along with fishing. Men have hunted for whales around Alaska for a long time, but not so many are caught now as in former years.

Once the sea otter was common, but now it has almost disappeared. Thousands of seals once covered some of the islands, but they were hunted so vigorously that a few years ago they too seemed doomed. The United States Government took charge of them, however, and forbade any one to kill them. They have now increased in numbers, and it will not be long until sealskins will again be plentiful in fur shops, as they were many years ago.

Sand otters, lynx, foxes, minks, bears, beavers, ermine and other fur-bearing animals are found, but the government allows them to be killed only at certain seasons of the year. Through these rules it is hoped that these animals will increase in numbers and that Alaska will continue to be able to furnish warm furs.

HOW THE REINDEER CAME TO ALASKA

The native inhabitants of Alaska are Eskimos and Indians. Most of them make their living by fishing and hunting. Sometimes game was scarce and they suffered from hunger. They had no domestic animals except dogs, which were used in hunting and to draw their sledges. Some wise men got the idea that the condition of the natives would be improved if they had a regular source of food, and, in 1892, the government began to bring in reindeer from Siberia. They were sold or loaned to the natives, who were taught to care for them. They have increased in numbers so rapidly that now they are sometimes killed for food. Many of the natives have herds of them and are growing prosperous. Their flesh is good for food, their skins for clothing, and they are trained to pull sledges.

RAILWAYS THE GREAT NEED OF THE COUNTRY

At the same time the population is very small. At the census of 1920 there were only about 28,000 white people, and 27,000 Indians and others in a territory almost one-fifth as large as the United States. It is plain that such a small population cannot build the railroads needed, but the population cannot grow large until the railroads are built. There are already several hundred miles, most of which has been built to connect mines with the seacoast, so that supplies and ore can be easily carried. The United States Government is building two longer lines which will do much to open the country. Some have dreamed of a road over the Aleutian Islands, which will connect by ferry with Siberia, so that one day we may go from the Atlantic coast to Paris by rail.

The government is building wagon roads, sled roads and trails in every direction. On some of them automobiles run, on others only sledges, drawn by dogs, or in a few cases by reindeer, can go, while only foot-passengers can travel some of the trails. Men often use the rivers as highways in winter when the ice is thick. In summer, when the ice has gone out, boats go up and down.

THE CRAFTY HUSKIES, WHICH DRAW THE SLEDGES

But although the railroads have pushed their way into portions of Alaska, and there are several hundred miles of wagon roads, they do not reach one-fifth of the field as yet, and sled dogs and a few reindeer are largely used for transportation. A good dog in Alaska is worth anywhere from $50 up. The thick-furred, long-legged "Labrador huskies" are the most powerful as well as the most valuable. "A load of 150 pounds per dog is the usual burden, and seven to nine dogs are attached, each by a separate trace. The Labrador harness is used with them, so the dogs spread out fan-shaped from the sledge and do not interfere with each other. The "malamutes," or native Indian dogs, usually half-wolf, are driven and harnessed differently,—all in a line and one before the other. The malamute is the king of all thieves. He will pull the leather boots off your feet while you sleep and eat them for a midnight supper, and he delights to eat up his seal-hide harness. He has learned to open a wooden box and will devour canned food, opening any tin can made, with his sharp fangs, quicker than any steel can-opener. Once a day only they are fed on raw fish, and while the malamute prefers to pilfer, the husky will go and fish for himself when off duty. Seventy miles a day is the rule with the Indians and their dog teams, and the white man does almost as much.

The dog-driver carries a club and seal-hide whip, both of which he uses un-

During the height of the rush to the gold fields, such a sight as this was not uncommon. As soon as the spring opened, men made their way over the trails, carrying their packs on their backs. One man is carrying a canoe, which he will launch on a stream when he reaches it.

mercifully, for the dogs are very fierce and delight in fighting. A fight among these fierce, half-tamed dogs of the North is not like the fights we see among our own. They fight wolf fashion, strike and leap away, strike and leap away—and the fight is to the death. Each dog knows this law and fights with a horrible intentness. Leap and slash, they fight—until lips and heads and bodies are gashed and bleeding. Around the combatants sits a staring circle of huskies. When either dog shows signs of losing his feet they stand up eagerly; and when at last the defeated dog goes down, they close in snarling and yelping, and the dog, screaming with agony, disappears underneath a heaving mass of bodies. There is no mercy shown among the creatures of this wild land. The toil of the traces seems the supreme expression of their being. Men wise in the ways of the wild will tell you that sick dogs have been known to die of a broken heart when cut out of the traces.

Here you see men digging for gold on the surface; placer mining, it is called. The dirt they have dug will be washed and the gold will settle to the bottom of the pan. Some men made fortunes in a few weeks if they were lucky. Now more gold is obtained from the deep mines.

POPULATION IS THE CHIEF NEED OF ALASKA

Alaska is a wonderful country, and will be visited by more and more tourists as its marvels become better known. It has high mountains, great glaciers, deep forests, beautiful fields, wonderful flowers, and interesting animals. Some volcanoes are still alive.

In all the vast area of Alaska, there are too few people to subdue the land. If this is to be done, men must go with their families expecting to remain. When the last census was taken there were five white men for every white woman in the territory. The reason for this is the fact that many young men have gone to Alaska to seek their fortunes, expecting to return to their former homes. Many find after they have lived in this northern land for a time that they can never be satisfied anywhere else. Some day, when the railroads are built, the tide will turn toward this great territory so full of riches of many kinds. Many places in Europe which are quite as far north are inhabited by large populations. Norway, Sweden and Finland are in about the same latitude. There is no reason why Alaska cannot support hundreds of thousands of settlers. Perhaps the day is not far when such numbers shall live there.

NEXT STORY OF THE UNITED STATES IS IN NEXT VOLUME.

Part of a frieze on the Temple of Apollo, near Phigalæia, in Arcadia, built in the year 470 B.C.

A LITTLE TALK ON SCULPTURE

CONTINUED FROM 4153

WHEN we hear people talk about art and artists, we usually at first think of pictures and painters, because in this country there are more pictures than sculptures. But art also includes music, architecture, decoration of houses, and what is perhaps the highest and noblest of all—sculpture. Few statues are seen in England, because the climate is cold and rainy and foggy, and statues in marble would not look well under these conditions. In Italy and France, where the sun is warmer, and fog and rain are comparatively rare, they have much sculpture, both in marble and in bronze.

To understand exactly what sculpture is, and what is good and what is bad, we must know what is meant by a statue, a relief, a bust, and a panel. And this is easily told.

A statue, as we all know, is a sculptured or carved figure of a human being or an animal. Statues may be life-size, larger than life, or smaller. When they are very small they are called statuettes. When they are much larger than life they are called heroic.

A bust is just the head and shoulders. A relief is a sculptured or carved figure, or several figures, or flowers, or anything else, on a background or slab. If we should see the Nelson column in Trafalgar Square, we shall notice that there are sculptured pictures at the sides of the base. These are reliefs—*high* reliefs, because they stand out boldly. If we see a relief that does not throw much shadow, we shall know it is a *low* relief. Panels are reliefs set in frames. The art of sculpture is very, very old. Even in the far-off days of Pharaoh even before the days of which we read in the Bible, there was sculpture.

The oldest important piece of sculpture that we know is the great Sphinx, a huge lion with a woman's head, half buried in the desert sand near the Pyramids in Egypt. The Egyptian sculpture was very simple and primitive, but at the same time refined and beautiful. In sculpture the Egyptians and Assyrians were the forerunners of the Greeks. That is to say, the Greeks followed the Egyptians in respect of time—in fact, the Greeks were at their best long after the Egyptians had done their best work.

Before the history of Egypt began, before the first dynasty, or family of kings, the prehistoric inhabitants carved figures, statues and heads, and many reliefs which, though crude, are good enough to show us that they must have been practising sculpture for a very long time before. Some of these very early works are in our great museums. The first dynasty began about 4800 B. C., and up to the end of the thirteenth dynasty, in 342 B.C., the sculpture of Egypt advanced to a very high standard. In 331 B.C. Alexander the Great conquered the Egyptians, and from that time their sculpture grew more and more like that of the Greeks.

THE TWO SOLITARY STATUES THAT KEEP GUARD OVER THE PLAIN OF EGYPT

Two pieces of the time of Amenhotep III. are so well known that we must remember them and the king who commanded them to be set up. These are the two gigantic statues on the plain near Thebes. They are sitting with their hands upon their knees, and seem to be keeping watchful guard over the plain and the distant temples and royal tombs.

After the death of Alexander the Great, in 323 B.C., Ptolemy I. ruled; and to the end of the Ptolemaic dynasty, when the Romans came to Egypt, the art of sculpture was influenced by the Greeks. But under the Romans it gradually sank and died out, just as the people themselves ceased to play a part in history. So we can leave them and pass to other countries.

We must remember that in Assyria they had sculpture just as in Egypt, but, like that of Egypt, it had but little influence upon other nations, and gradually died out. But now we come to the Greeks—the great nation that produced the best sculpture the world has ever seen. From 1000 B.C. to about 550 B.C. it was archaic—they made statues as a child of to-day would make them—stiff and lifeless. From about 550 B.C. to 430 B.C. they developed their art and tried to make statues more like real beings. This advance was first made in Ionian Asia Minor. The Ionian merchants were very much in touch with Egypt and Babylonia, and so the art of the Ionians was somewhat influenced by these countries.

THE GREAT GREEK MASTERS AND THEIR WONDERFUL WORKS IN STONE

But Greek sculpture was also slowly advancing in Argos and Attica, where the sculptors met and saw each other's work, and so their statues became more like each other, the one sculptor adopting in his statues points that he found best in the other's work. The Greeks were very fond of athletic games, which were of such importance to them that they often made statues of the Olympic champions. One of these statues, the Discobolus, by Myron, is in the Ashmolean Museum, Oxford. It is a beautiful statue of a disk-thrower—disk-throwing being a sport of which the Greeks were very fond. Two of the very finest examples of Greek sculpture can be seen in the British Museum. One is of draped figures, the other a nude figure. The former are the Three Fates, from the Parthenon at Athens; the latter is the Theseus, from the same temple. The whole decoration of the Parthenon is the work of Phidias, the greatest of all Greek sculptors. Other great sculptors were Polycletus, Praxiteles, Scopas, and Lysippus.

Among the most famous works that have been preserved to our day are the wonderful Venus of Milo, at the Louvre in Paris, named after the island of Milo or Melos, where it was found; the Victory of Samothrace, the Doryphoros by Polycletus, and the Hermes by Praxiteles.

THE DARK AGES IN WHICH THE ART OF SCULPTURE DISAPPEARED

Greek sculpture developed and flourished up to 150 B.C., about which time the Romans, under Mummius, conquered Greece. The Romans not only carried off the finest works produced by the conquered people, but induced the best Greek artists and craftsmen to come to Italy, so that Greece ceased to produce great works, while the sculptors of the Roman Empire devoted themselves mainly to the making of portrait busts and the copying of famous Greek originals, until the art declined altogether at the time of the fall of the empire.

In the so-called "Dark Ages," sculpture was of very little account. It was believed that the end of the world would come in 1000 A.D., and we can easily understand that as this year approached everyone grew more and more alarmed, and cared very little about decorating the cities and houses. Thus sculpture died out almost entirely. Nobody wanted it, nobody practised the art. At last the year 1000 ended, and nothing had happened. People began to realize that they had been mistaken. Then, as they were able to feel more sure of this, they became very thankful to God, and grew more religious. They built many churches and cathedrals, and consequently a new demand arose for sculpture.

France was the first country to revive this art. Cathedrals were built, for instance, at Rouen, Amiens, Chartres, Bayeux, Rheims, and Bourges, and, in all these, many statues were placed. In England, also, the religious movement grew, and during the next 500 years most of the cathedrals were built.

THE FINE RELIGIOUS SCULPTURES CARVED BY THE OLD STONEMASONS

The sculptures in these buildings were not done by what we should call great sculptors, for there were none in those days. The stone-carvers were just simple tradesmen, or craftsmen, like the stonemasons. They learned their trade, or craft, from their fathers, who had learned it from their fathers before them. It was not until the time of Queen Elizabeth that sculpture really found a footing in England, and that sculptured figures and statues began to be used to any great extent.

The great movement of the Renaissance, which means *re-birth*—the rebirth of classic art and classic learning—began in Italy. The cathedral sculptors belonged to the so-called *Gothic* period, and, with all their love of beautiful detail and their deep feeling, they were often awkward and stiff, lacking in dignity and personal style.

The first great Italian sculptor was Niccola Pisano, who was born about 1206 and died in 1278. While still influenced by the Gothic carvers, he had studied the scarce examples of classic art that had come to his notice.

He had many followers, the most famous of whom were his son Giovanni, and Andrea Pisano, who lived from about 1270 to 1349, working much of the time in Florence. Now the sculptors increased in numbers, and they wished to imitate the Greeks and Romans no more, but rather, like the Greeks, to copy Nature as they found her. They made men in stone as they appeared to be in life, and they carved flowers and trees and animals just as naturally as they could.

THE MODERN MASTERS AND THEIR SPLENDID HORSEBACK SCULPTURES

In 1378, Lorenzo Ghiberti was born in Florence, and he has left in that city many beautiful works, such as the famous bronze gates of the Baptistery, that we see on page 2786. Donatello, his pupil, was born about 1386. He made even a greater name than his master, and three of his best works are the St. George and the David in Florence, and the Gattamelata in Padua, the first large equestrian, or horseback, monument of modern times. From year to year the arts of painting, architecture, and sculpture advanced. After Donatello came Jacopo della Quereia and Luca della Robbia. Luca modeled the little white babies on blue backgrounds, reproductions of which we see in the large stores. Then came Verrocchio, born in 1435, who, together with Leopardi, made the wonderful Colleoni monument in Venice, the finest equestrian statue in the world.

At last we come to the greatest of the Renaissance sculptors, Michael Angelo, born in 1475. He was a good painter and a great architect, but his sculpture astonished all who saw it, and it remains some of the best work the world has ever seen. We can only mention his chief works here. These are: David, a colossal statue, and the Medici tombs in Florence; and Moses, and the Pietà in Rome. Benvenuto Cellini, goldsmith and sculptor, and Giovanni Bologna followed; and Bernini carried on the spirit of the Renaissance to about 1680, although the work of Bernini shows much of the exaggerated restlessness and floridness of what is now commonly known as the *baroque*, or uncouth and irregular, period.

HOW THE SCULPTORS SPOILED THEIR WORK IN TRYING TO MAKE IT BETTER

Sculpture now was on the decline. Instead of keeping their works strong and simple, the artists made them more and more elaborate and delicate. Sculpture had reached its best, and Bernini, in trying to make it better by copying every little detail, spoiled it and weakened it by not making it sufficiently simple. His bad qualities were copied and imitated and increased by the sculptors who came after; and thus the art grew worse and worse. The decline was not like that of Egypt, where sculpture was stopped and stamped out by the Roman conquest, but it simply became more tasteless, too ornate, and too extravagant.

Meanwhile, sculpture in France had progressed under Francis I., who became king in 1515. He encouraged art with great energy, and in building his palaces he employed such sculptors as Goujon, Cousin, Pilon, and many others. Chief of them was Jean Goujon, whose Diana, now at the Louvre in Paris, is sufficient to make him famous. Pierre Puget followed, and Girardon, Falconet, and Pigalle. But we need not stay here to mention their work, for they belong to an indifferent period. It is better to begin again with the modern men, who started yet another revival of sculpture, which is still advancing.

HOW THE MODERN SCULPTORS TRIED TO REVIVE THE CLASSIC STYLE AND FAILED

Of these men, Clodion and Houdon were eminent. Though they followed and were influenced by those whom we have just mentioned, their work was simpler and more refined. After them came a period in which sculptors tried to revive, or imitate, the style of the Greeks. This attempt was made not only in France, Italy, and Belgium, but also in England, where little had been done, so far, in sculpture.

The imitation classic revival lasted roughly from 1789 to 1848. The men responsible for it were chiefly Canova in Italy, Thorwaldsen in Denmark, and Flaxman in England. Their works were cold, and did not seem to live; nor were they pleasing, because they did not look like men who lived and worked—they were simply commonplace imitations of the Greek statues, which they did not really understand. They did not know why Greek statuary was so good; and, in copying, left out all that was fine and beautiful, and thus made statues that were extremely dull and lifeless, very lumpy and heavy, and quite uninteresting.

THE SCULPTOR'S RETURN TO NATURE AND THE STATUES OF REAL PEOPLE

But now Englishmen began to think more of art. They were at first pleased and impressed with the imitation of Greek, because they thought they were making sculpture just like the ancient Greeks. Flaxman, who modeled the beautiful reliefs on Wedgwood vases and plaques, introduced the classic, or Greek, idea into England.

But soon sculptors tired of it. They wished to represent and carve, not Greek gods, but men and women of their own time. Thus they began to be more real, and to copy Nature instead of the work of men who lived in the ages before Christ. Chantrey and Gibson in England, and Dubois and Dalou in France, made this change felt; and it was further advanced by Alfred Stevens, Lord Leighton, Onslow Ford, Hamo Thornycroft, and others. Steven's' Wellington Memorial in St. Paul's Cathedral is the finest monument ever produced by a British artist. Leighton's Athlete and Python are in the Tate Gallery, together with Onslow Ford's Egyptian Singer. In the United States many men have done good work. Augustus St. Gaudens excelled in low relief and his equestrian statue of Sherman is a great work. Frederic Macmonnies' Bacchante has now much praise, and his fame is increasing as the years go by. George G. Barnard has produced some striking figures for the capitol of Pennsylvania. We tell elsewhere of several sculptors of Canada and the United States.

AUGUSTE RODIN, THE GREATEST OF MODERN SCULPTORS

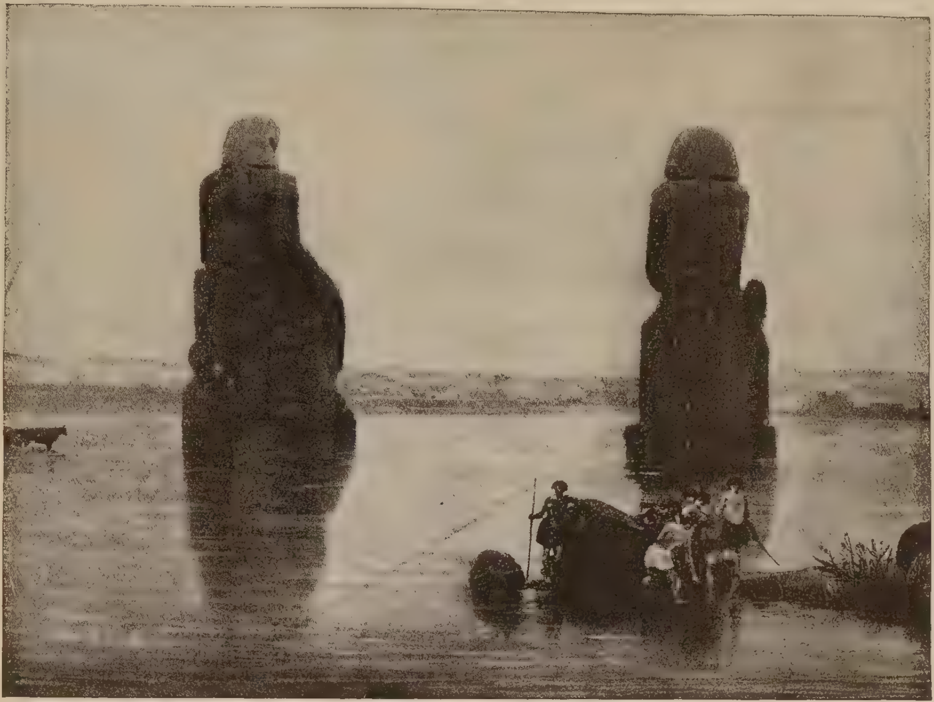
The greatest of modern sculptors is, some think, the Frenchman Auguste Rodin. He is unlike any other sculptor, except, perhaps, the Belgian Constantin Meunier. While Meunier was making sculptures of working men and women and making them look like peasants and laborers, Rodin was breaking away from the academic school—the set of sculptors who thought sculpture must be smooth and classic in pose—and was picturing, in marble and bronze, people *as he saw them.* Rodin has made his figures in natural attitudes, which was not done before, because people were used to the stiff and academic positions, such as we see in the work of the imitation classic period.

The Dock Laborer, by Meunier, is in the Luxembourg Museum in Paris, besides his Puddlers at the Furnace and The Glebe. The Kiss, by Rodin, is in the same museum; while the Pantheon, in Paris, possesses the Thinker, one of his best works. There are also some of his remarkable sculptures in London, and the Metropolitan Museum in New York owns a very fine collection of his work.

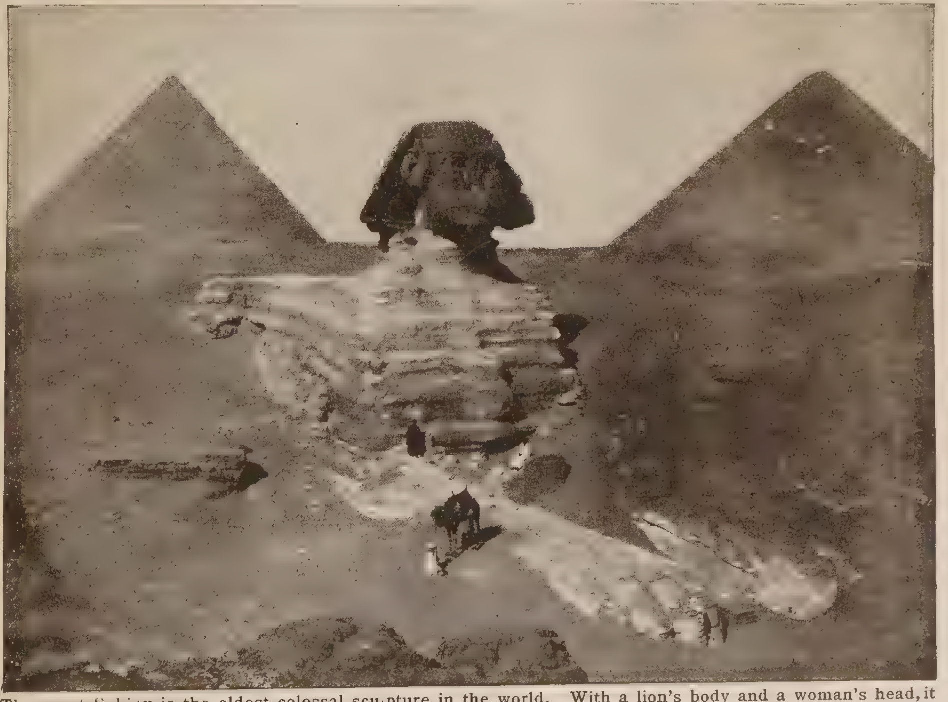
Our younger sculptors in America are doing beautiful work; and sculpture in America is now, it is safe to say, as good as any modern sculpture of other countries. These men are thinking more for themselves, and not copying old work.

THE NEXT FAMILIAR THINGS ARE ON PAGE 4241.

THE MIGHTY SCULPTURES OF OLD EGYPT

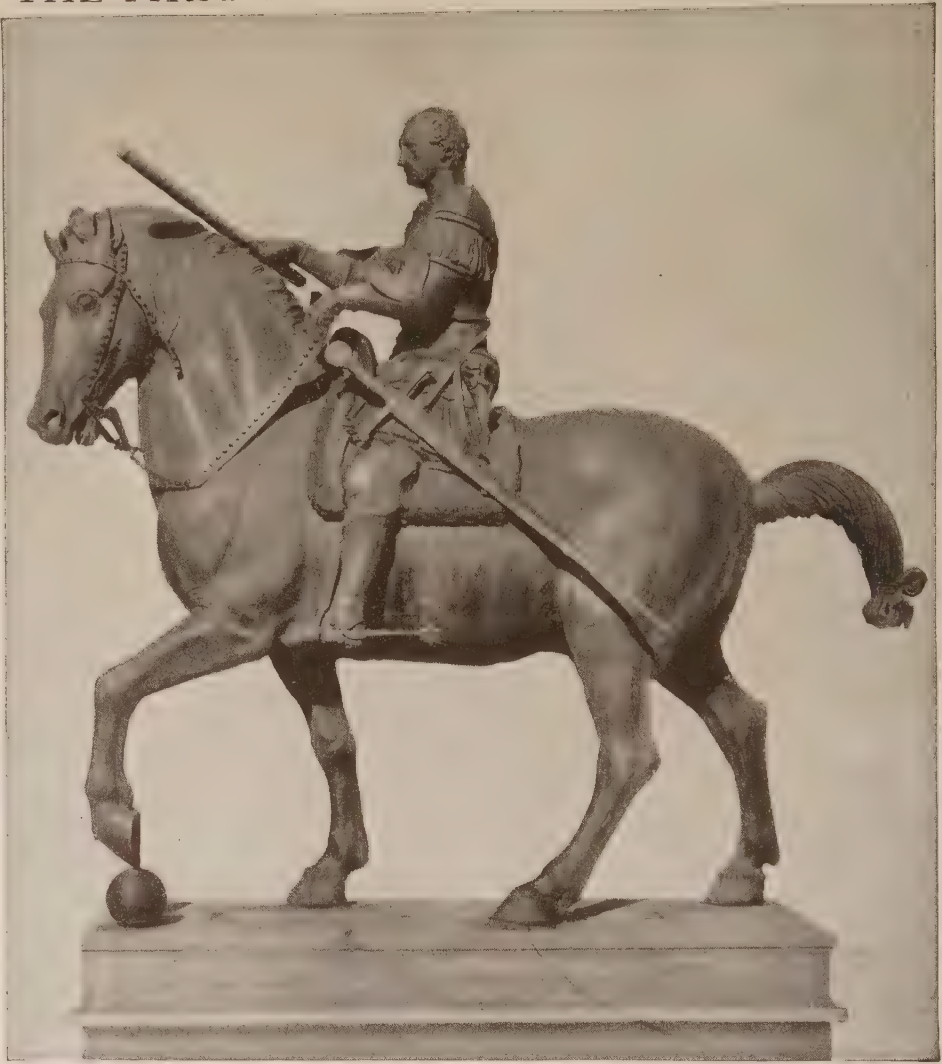


Here are two gigantic statues set up near Thebes in Egypt about 1400 B.C. They are the largest seated figures in the world, and are made of sandstone quarried near the Nile. One of them was called the Singing Memnon, because of the sound said to be given out by the stone when warmed by the morning sun.

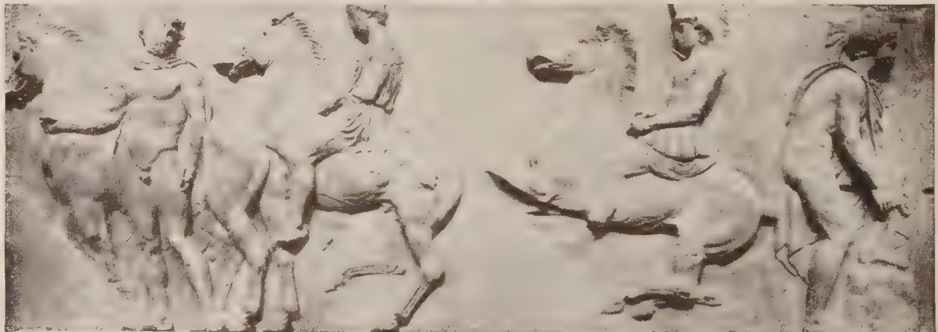


The great Sphinx is the oldest colossal sculpture in the world. With a lion's body and a woman's head, it lies on the edge of the desert, carved out of a huge rock protruding from the sand. It is about five thousand years old. The mystery of this strange statue has always proved very fascinating to imaginative minds.

THE FIRST MODERN HORSEBACK STATUE

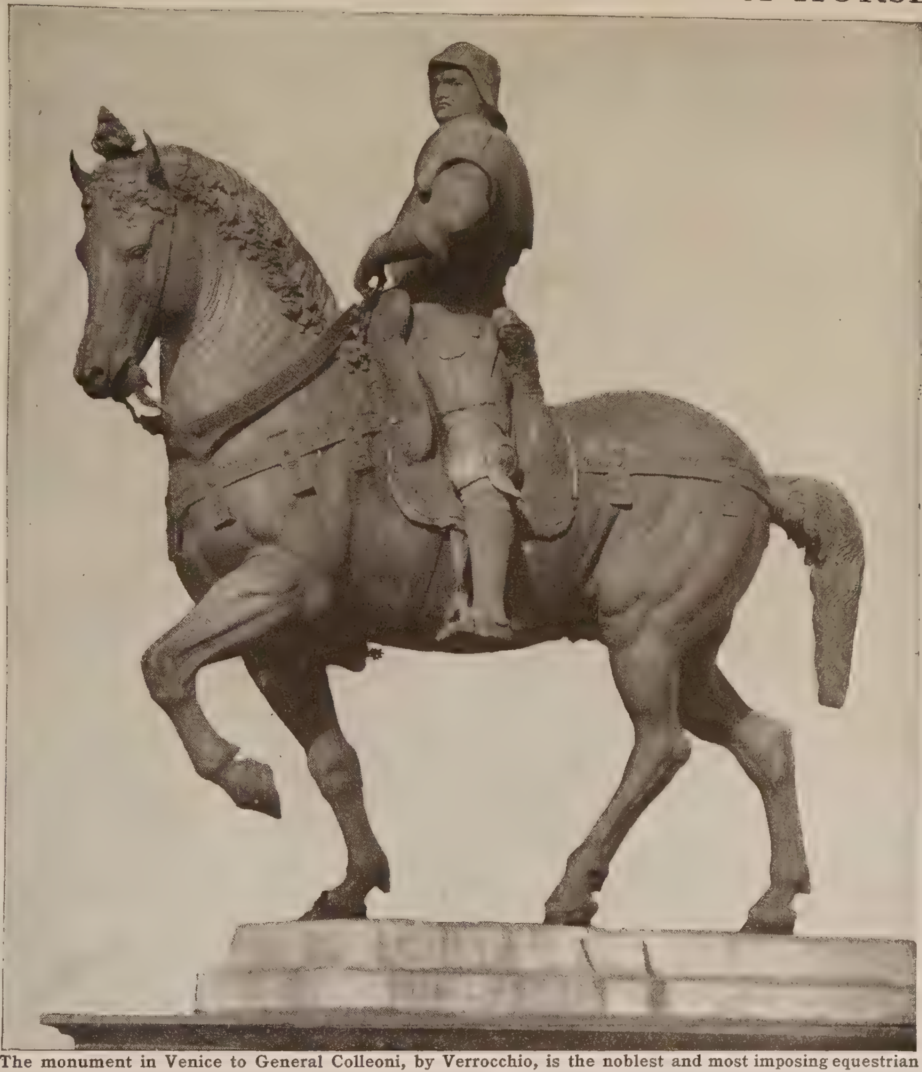


The monument of General Gattamelata on horseback, by Donatello, is the first equestrian monument of modern times. In his days, nobody but Donatello could have undertaken the difficult task of casting a horse on heroic scale in bronze, and even he found it necessary to place the raised forefoot on a ball for support.

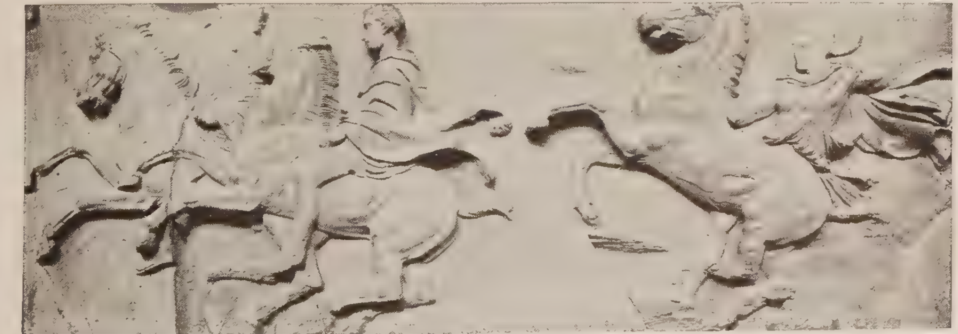


Here is part of the frieze which decorated the Parthenon at Athens. This is the work of Phidias, and surpasses in beauty any work the world has seen. The spacing of the figures and sense of movement are marvelous. The whole design represents a long procession of mounted horsemen going to sacrifice to a god.

THE WORLD'S FINEST STATUE OF A HORSE

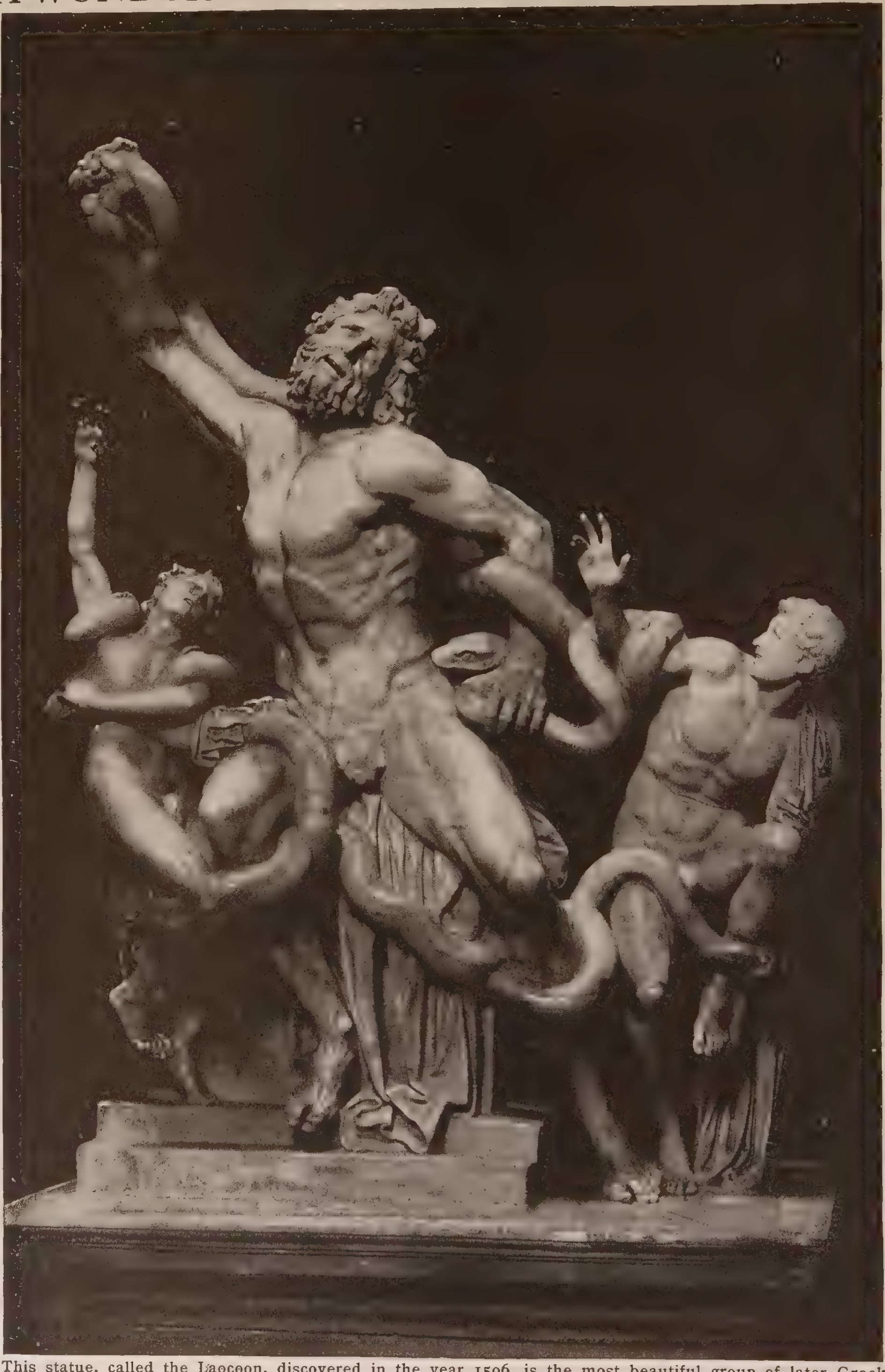


The monument in Venice to General Colleoni, by Verrocchio, is the noblest and most imposing equestrian monument in the world. See how proudly the bold soldier sits his horse; note the vigorous action of his arm, the defiant, commanding expression of his features, and the effect of a forward movement in the horse.



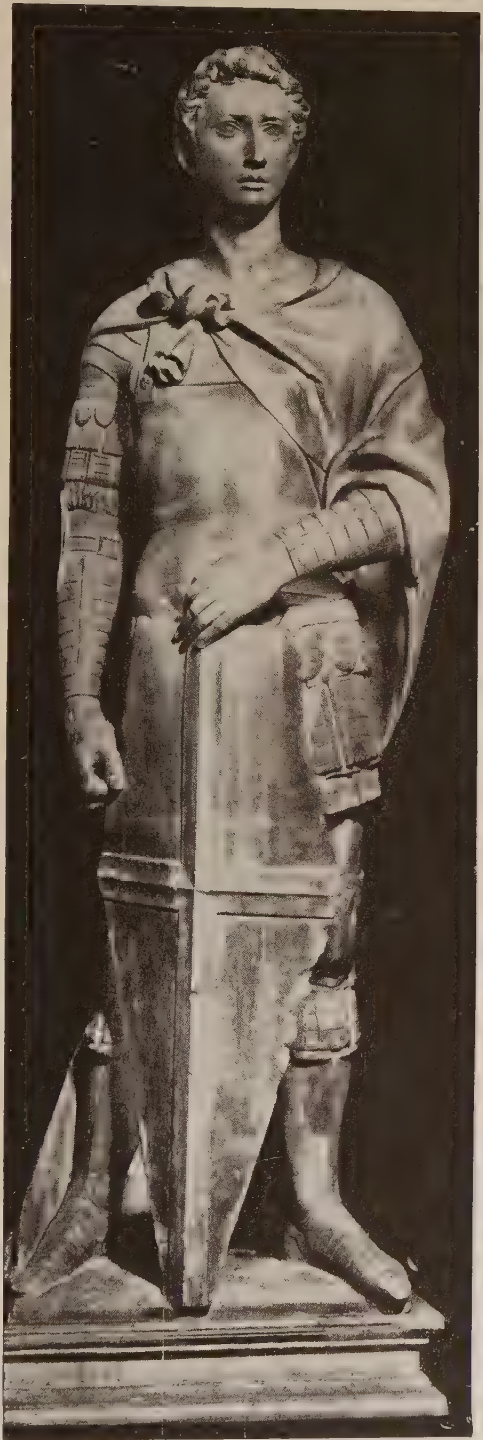
This part of the Parthenon frieze shows even more vividly than that on page 4176 the sense of movement created by the lines of the horses' legs and the drapery. A notable thing is the completion of action in the frieze. One horse raises his leg, the next horse raises his higher, and so on till the action is completed.

A WONDERFUL GROUP THAT SEEMS TO MOVE

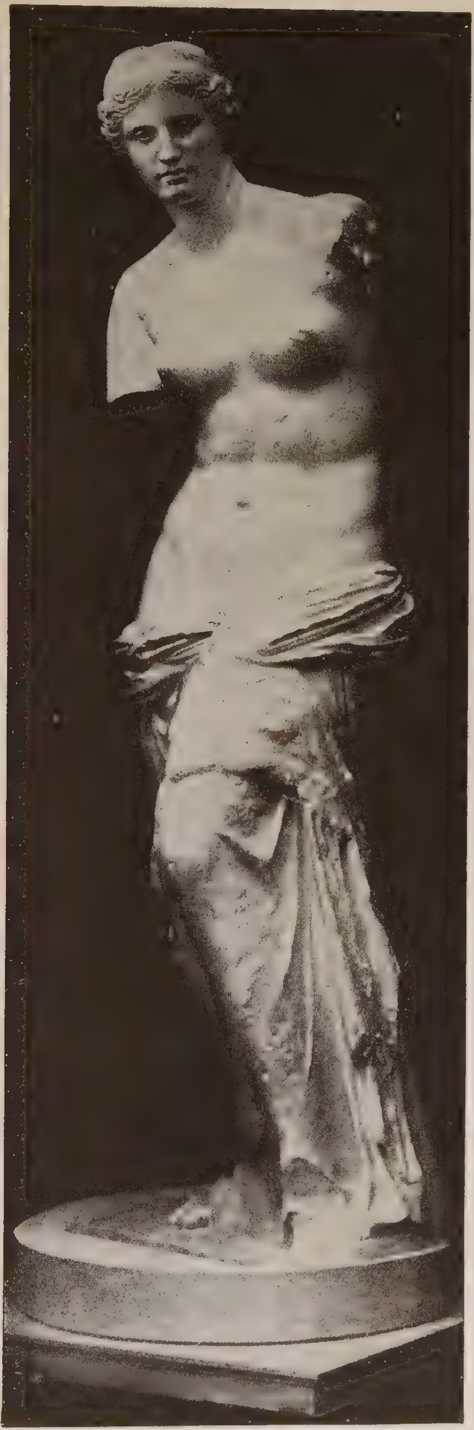


This statue, called the Laocoon, discovered in the year 1506, is the most beautiful group of later Greek sculpture, when artists were no longer satisfied with simple figures in repose or moderate action, and tried to express violent movement and passion. It is the work of Agesander, Polydorus, and Athenodorus.

TWO OF THE WORLD'S FINEST STATUES

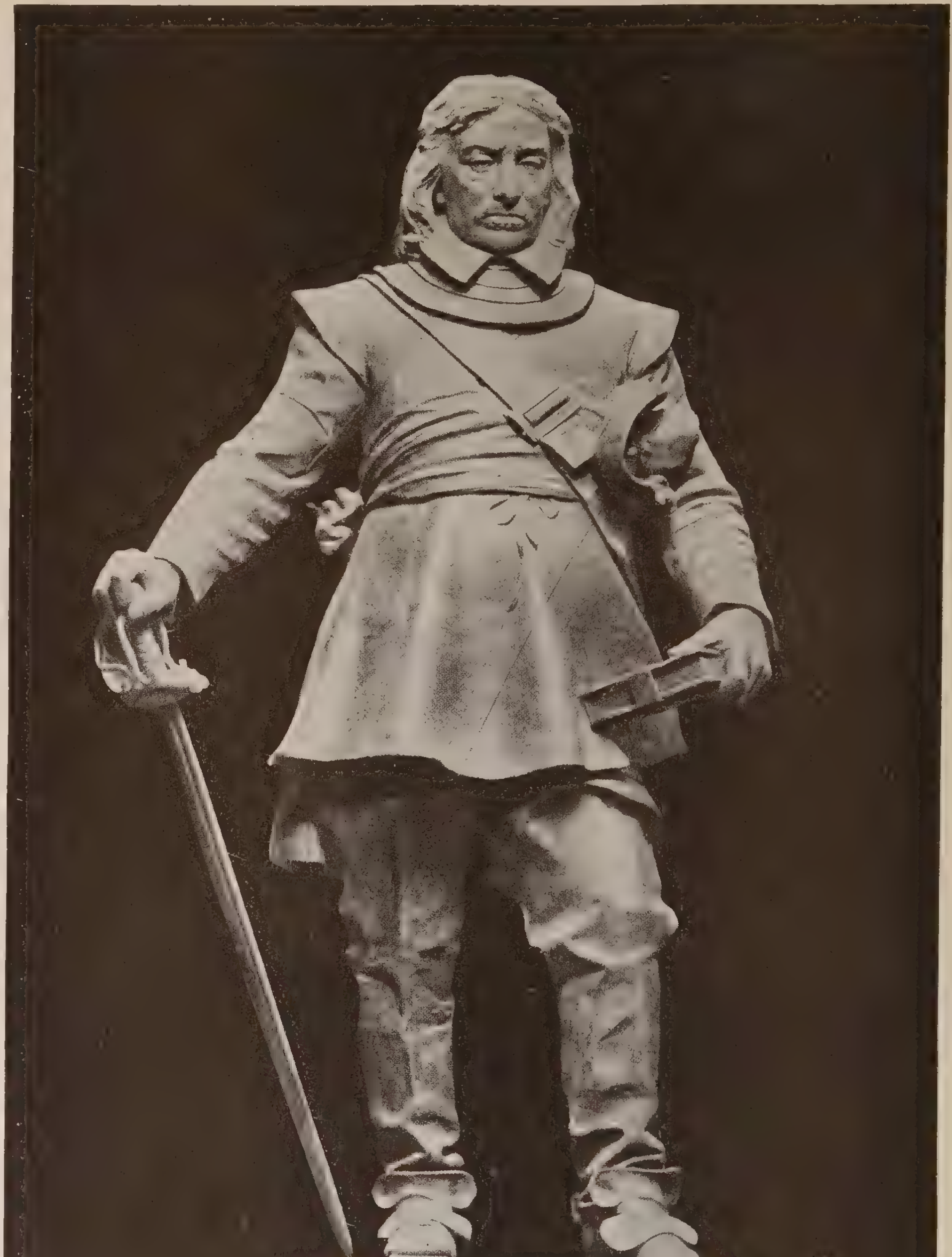


Donatello's St. George in Florence is perhaps the finest example of armor in sculpture. The hard and metallic appearance of the armor is softened and beautified by the clinging of the garments to the body.



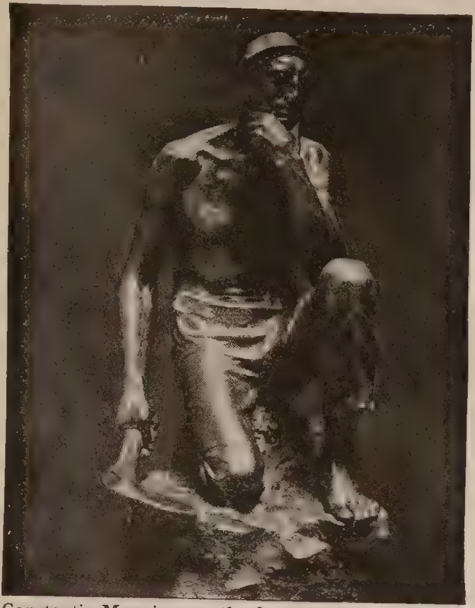
The Venus of Milo, so called from the island where it was found, is the most perfect female statue in the world. The surfaces are broad and simple. The grace of outline and the modeling have never been equaled.

OLIVER CROMWELL AT WESTMINSTER

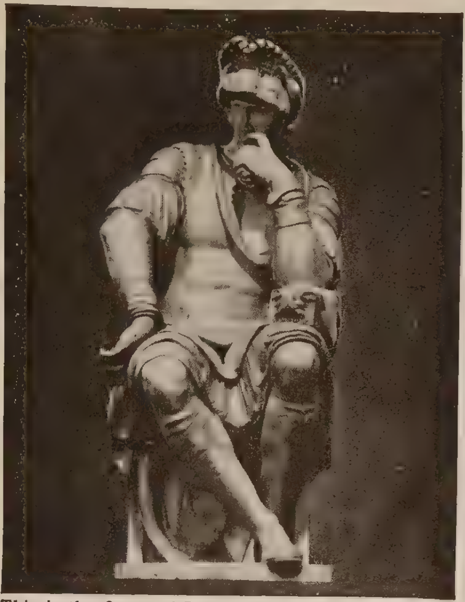


Oliver Cromwell, by Hamo Thornycroft, is a good example of modern English sculpture. Note how the artist has expressed, in the firm attitude of the short-set figure and in the resolute face, the character of the man of action. His life was determined by the Bible and the sword; and both are happily introduced.

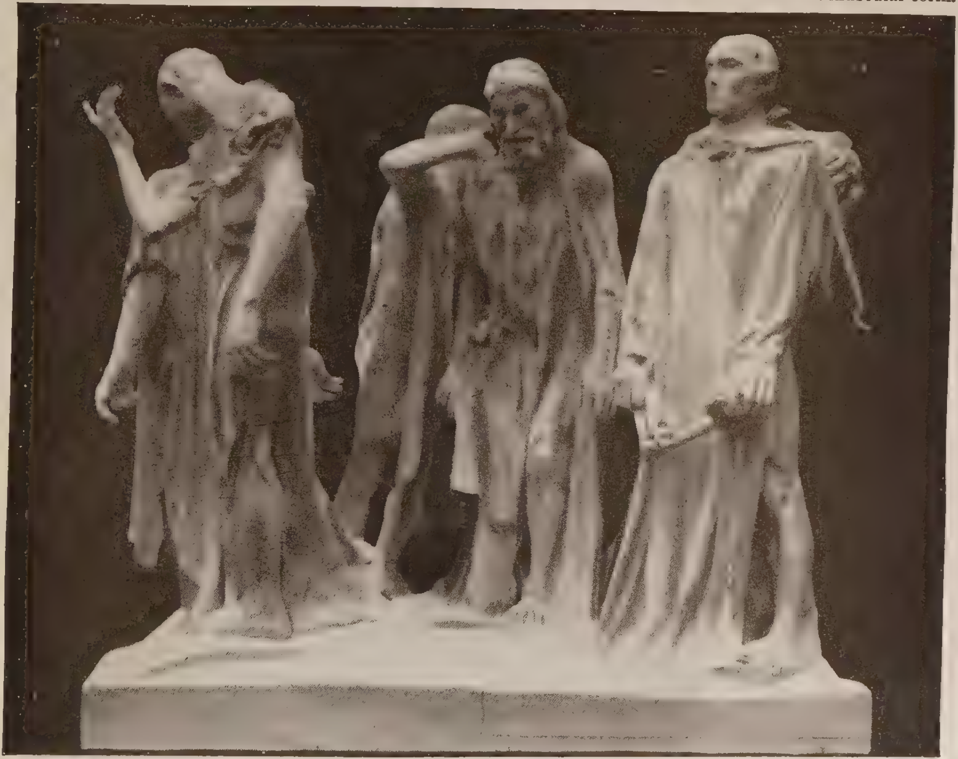
GREAT SCULPTURES OF MODERN MASTERS



Constantin Meunier was the first sculptor to represent the working man. This example is one of his strong and exceedingly simple works. The light falls softly over the modeling; only the big forms are modeled.

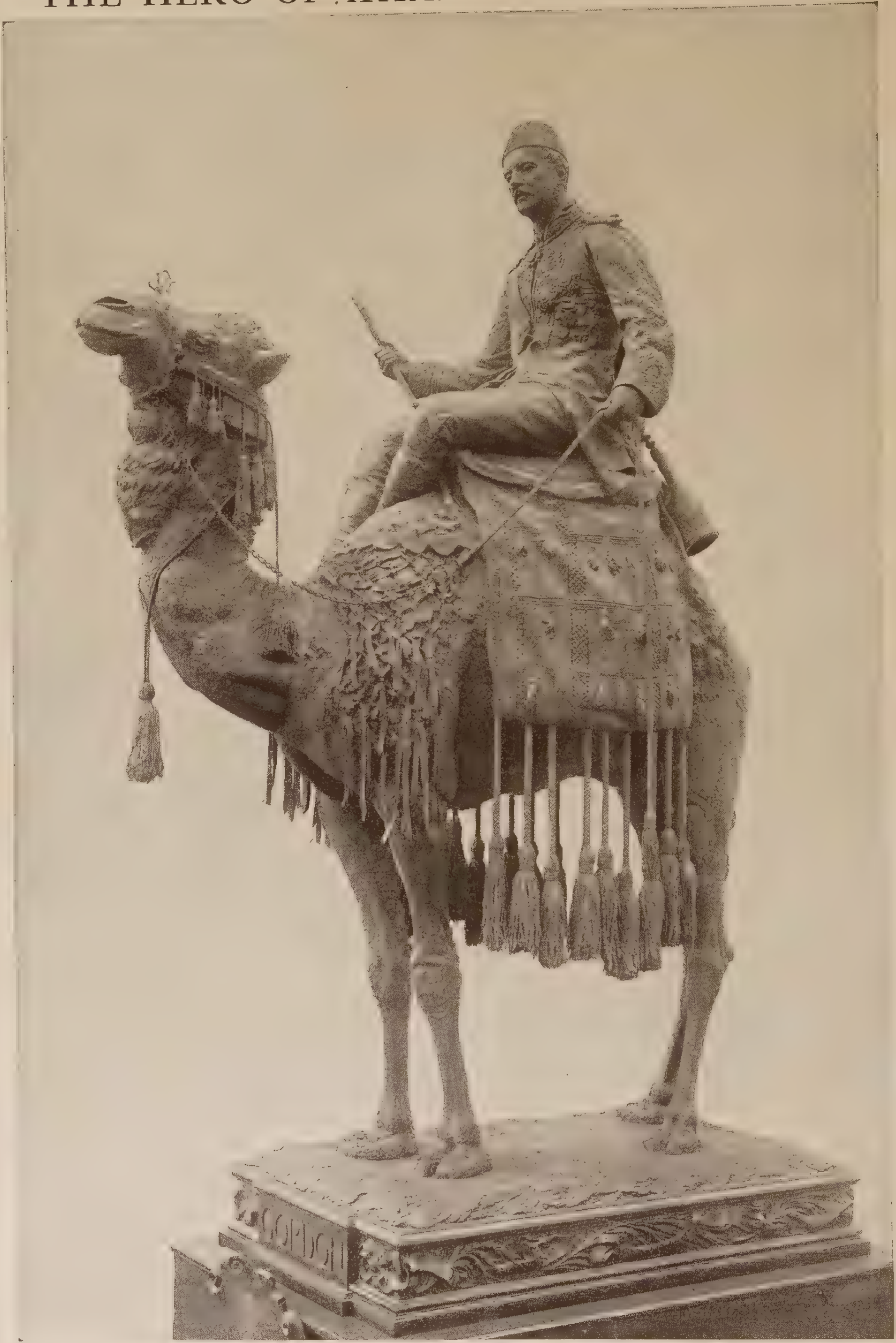


This is the figure of Lorenzo de Medici on his tomb in Florence. Michael Angelo thought of splendid gestures, unlike the gestures of other statuary of his time. He made the most of beautiful muscular form.



The Citizens of Calais, by Auguste Rodin represents the men who, at the command of Edward III. of England went out of the city to his camp with ropes round their necks. There is pathos in their hopeless sorrow; anguish is portrayed in all their features, and everything is done to direct attention toward their grief.

THE HERO OF KHARTOUM IN BRONZE



General Gordon, the hero of Khartoum, is here represented in bronze by Onslow Ford. The careful work put on the elaborate trappings of the camel and the details of the uniform detract from the grandeur and impressiveness of the conception, and as a result of this minute detail the monument suffers in massive effect.

The photograph of General Gordon on this page is by Messrs. Russell; the others are by Messrs. Anderson, Beato, Neurdein, and Mansell.

THE NEXT FAMILIAR THINGS ARE ON PAGE 4241.

A BALLAD OF THE FLEET

THERE are few tales of heroism to compare with that of Sir Richard Grenville, one of the brave sailors of Queen Elizabeth's day. In August, 1591, when he was commanding the Revenge in Lord Thomas Howard's squadron, they fell in with a great Spanish fleet of fifty-three vessels off the Azores Islands in mid-Atlantic. The admiral made good his escape with five vessels, but Sir Richard Grenville refused to show flight before the hated Spaniards, and, though certain death was the prospect of his engaging their great fleet with his one little vessel, he sailed the Revenge into the thick of them and fought from three in the afternoon until next morning. So gallantly did he command his little ship that fifteen of the great Spanish men-of-war were beaten off, two of them were sunk, and two more disabled. Some two thousand Spanish sailors were killed or drowned before Sir Richard, fatally wounded, gave in. The poem is by Lord Tennyson.

THE REVENGE

CONTINUED FROM 4068

AT Flores in the Azores Sir Richard Grenville lay,
And a pinnace, like a flutter'd bird, came flying from far away:
"Spanish ships of war at sea! we have sighted fifty-three!"
Then spake Lord Thomas Howard: " 'Fore God I am no coward;
But I cannot meet them here, for my ships are out of gear,
And the half my men are sick. I must fly, but follow quick,
We are six ships of the line; can we fight with fifty-three?"

Then spake Sir Richard Grenville: "I know you are no coward;
You fly them for a moment to fight with them again.
But I've ninety men and more that are lying sick ashore;
I should count myself the coward if I left them, my Lord Howard,
To these Inquisition dogs and the devildoms of Spain."

So Lord Howard passed away with five ships of war that day,
Till he melted like a cloud in the silent summer heaven;
But Sir Richard bore in hand all his sick men from the land
Very carefully and slow,
Men of Bideford and Devon,
And we laid them on the ballast down below;
For we brought them all aboard,
And they blest him in their pain, that they were not left to Spain,
To the thumbscrew and the stake, for the glory of the Lord.

He had only a hundred seamen to work the ship and to fight,
And he sailed away from Flores till the Spaniard came in sight,
With his huge sea-castles heaving upon the weather bow.
"Shall we fight or shall we fly?
Good Sir Richard, tell us now;
For to fight is but to die!
There'll be little of us left, by the time this sun be set."
And Sir Richard said again: "We be all good Englishmen;
Let us bang these dogs of Seville, the children of the devil,
For I never turned my back upon don or devil yet."

Sir Richard spoke and he laugh'd, and we roar'd a hurrah, and so
The little Revenge ran on, sheer into the heart of the foe,
With her hundred fighters on deck and her ninety sick below;
For half of their fleet to the right and half to the left were seen,
And the little Revenge ran on, thro' the long sea-lane between.
Thousands of their soldiers looked down from their decks and laugh'd,
Thousands of their seamen made mock at the mad little craft
Running on and on, till delay'd
By their mountain-like San Philip, that, of fifteen hundred tons,
And up-shadowing high above us with her yawning tiers of guns,
Took the breath from our sails and we stay'd.
And while now the great San Philip hung above us like a cloud
Whence the thunderbolt will fall
Long and loud,
Four galleons drew away
From the Spanish fleet that day,
And two upon the larboard and two upon the starboard lay,
And the battle-thunder broke from them all.

And the sun went down, and the stars came out, far over the summer sea,
But never a moment ceased the fight of the one and the fifty-three.

Ship after ship, the whole night long, their
high-built galleons came,
Ship after ship, the whole night long, with her
battle-thunder and flame;
Ship after ship, the whole night long, drew
back with her dead and her shame,
For some were sunk, and many were shatter'd,
and so could fight us no more—
God of battles, was ever a battle like this in
the world before?

For he said: "Fight on! fight on!"
Tho' his vessel was all but a wreck;
And it chanced that, when half of the short
summer night was gone,
With a grisly wound to be dressed, he had
left the deck,
But a bullet struck him that was dressing it
suddenly dead,
And himself he was wounded again, in the side
and the head,
And he said: "Fight on! fight on!"

And the night went down, and the sun smiled
out far over the summer sea,
And the Spanish fleet, with broken sides, lay
round us, all in a ring;
But they dared not touch us again, for they
feared that we still could sting.
So they watched what the end would be.
And we had not fought them in vain,
But in perilous plight were we,
Seeing forty of our poor hundred were slain,
And half of the rest of us were maim'd for life
In the crash of the cannonades and the desperate
strife;
And the sick men down in the hold were
most of them stark and cold,
And the pikes were all broken and bent, and
the powder was all of it spent;
And the masts and the rigging were lying over
the side;
But Sir Richard cried in his English pride:
"We have fought such a fight for a day and
a night
As may never be fought again!
We have won great glory, my men!
And a day less or more
At sea or ashore,
We die—does it matter when?
Sink the ship, Master Gunner—sink her,
split her in twain!
Fall into the hands of God, not into the hands
of Spain!"

And the gunner said: "Ay, ay," but the
seamen made reply:
"We have children, we have wives,
And the Lord hath spared our lives.
We will make the Spaniard promise, if we
yield, to let us go;
We shall live to fight again and to strike
another blow."
And the lion there lay dying, and they yielded
to the foe.

And the stately Spanish men to their flagship
bore him then,
Where they laid him by the mast, old Sir
Richard caught at last,
And they praised him to his face with their
courtly foreign grace;
But he rose upon their decks, and he cried:
"I have fought for Queen and Faith, like a
valiant man and true;
I have only done my duty, as a man is bound
to do;
With a joyful spirit, I, Sir Richard Grenville,
die!"
And he fell upon their decks, and he died.

And they stared at the dead that had been so
valiant and true,
And had holden the power and glory of Spain
so cheap
That he dared her with one little ship and his
English few;
Was he devil or man? He was devil for aught
they knew,
But they sank his body with honour down
into the deep,
And they mann'd the Revenge with a swarthier
alien crew,
And away she sail'd with her loss, and long'd
for her own;
When a wind from the lands they had ruin'd
awoke from sleep,
And the water began to heave, and the weather
to moan,
And ere ever that evening ended a great gale
blew,
And a wave like the wave that is raised by an
earthquake grew,
Till it smote on their hulls and their sails and
their masts and their flags,
And the whole sea plunged and fell on the
shot-shatter'd navy of Spain,
And the little Revenge herself went down
by the island crags,
To be lost evermore in the main.

FAITH

This familiar hymn, a favorite in all churches, has been translated into twenty languages. It was written by Ray Palmer, a clergyman who died in Newark, N. J., in 1887.

MY faith looks up to Thee,
Thou Lamb of Calvary,
Saviour divine!
Now hear me while I pray,
Take all my guilt away,
O let me from this day
Be wholly Thine!

May Thy rich grace impart
Strength to my fainting heart,
My zeal inspire;
As Thou hast died for me,
O may my love for Thee
Pure, warm, and changeless be,—
A living fire!

While life's dark maze I tread,
And griefs around me spread,
Be Thou my guide;
Bid darkness turn to day,
Wipe sorrow's tears away,
Nor let me ever stray
From Thee aside.

When ends life's transient dream,
When death's cold, sullen stream
Shall o'er me roll:
Blest Saviour, then, in love,
Fear and distrust remove;
O bear me safe above,
A ransomed soul!

THE BOY AND THE ANGEL

Robert Browning seeks to illustrate in this poem one of the greatest truths of life. The poor boy Theocrite, sincerely praising God each day, foolishly comes to think that God would be better pleased to be praised in the "great way" of the Pope of Rome, and so his ambition is to become the Pope. But God would as soon have the simple praise of the workman at his bench as that of the richest of magnates. So the poet imagines the angel Gabriel coming down to earth to take the place of the poor workman Theocrite, while Theocrite has climbed into the papal chair. Thus, in the end the angel shames the boy. The lesson is that, no matter what our condition of life may be, we are all free to praise God in our own way.

MORNING, evening, noon and night,
"Praise God!" sang Theocrite.

Then to his poor trade he turned,
By which the daily meal was earned.

Hard he laboured, long and well;
O'er his work the boy's curls fell.

But ever, at each period,
He stopped and sang: "Praise God!"

Then back again his curls he threw,
And cheerful turned to work anew.

Said Blaise, the listening monk: "Well done;
I doubt not thou art heard, my son:

"As well as if thy voice to-day
Were praising God the Pope's great way.

"This Easter Day, the Pope at Rome
Praises God from Peter's dome."

Said Theocrite: "Would God that I
Might praise him that great way, and die!"

Night passed, day shone,
And Theocrite was gone.

With God a day endures alway,
A thousand years are but a day.

God said in heaven: "Nor day nor night
Now brings the voice of my delight."

Then Gabriel like a rainbow's birth,
Spread his wings and sank to earth;

Entered, in flesh, the empty cell,
Lived there, and played the craftsman well.

And morning, evening, noon and night,
Praised God in place of Theocrite.

And from a boy to youth he grew
The man put off the stripling's hue.

The man matured and fell away
Into the season of decay;

And ever o'er the trade he bent,
And ever lived on earth content.

(He did God's will; to him, all one
If on the earth or in the sun.)

God said: "A praise is in mine ear;
There is no doubt in it, no fear:

"So sing old worlds, and so
New worlds that from my footstool go.

"Clearer loves sound other ways:
I miss my little human praise."

Then forth sprang Gabriel's wings, off fell
The flesh disguise, remained the cell.

'Twas Easter Day: he flew to Rome,
And paused above Saint Peter's dome.

In the tiring-room close by
The great outer gallery,

With his holy vestments dight,
Stood the new Pope, Theocrite;

And all his past career
Came back upon him clear,

Since when, a boy, he plied his trade,
Till on his life the sickness weighed;

And in his cell, when death drew near,
An angel in a dream brought cheer;

And rising from the sickness drear
He grew a priest, and now stood here.

To the East with praise he turned,
And on his sight the angel burned.

"I bore thee from thy craftsman's cell
And set thee here; I did not well.

"Vainly I left my angel's sphere,
Vain was thy dream of many a year.

"Thy voice's praise seemed weak; it dropped—
Creation's chorus stopped!

"Go back and praise again
The early way, while I remain.

"With that weak voice of our disdain,
Take up creation's pausing strain.

"Back to the cell and poor employ:
Become the craftsman and the boy!"

Theocrite grew old at home;
A new pope dwelt in Peter's dome.

One vanished as the other died:
They sought God side by side.

AN EVENING HYMN

One of the most beautiful of hymns for the evening hour is the following, written by the Rev. James Drummond Burns, a Scottish minister, who was born in 1823, and died at Mentone in 1864. Samuel, of course, was one of the great prophets of Israel, and in this hymn his qualities of mind and heart are chosen as worthy of our emulation.

HUSH'D was the evening hymn,
The temple courts were dark;
The lamp was burning dim
Before the sacred ark,
When suddenly a voice divine
Rang through the silence of the shrine.

Oh, give me Samuel's ear—
The open ear, O Lord!
Alive and quick to hear
Each whisper of Thy word;
Like him to answer at Thy call,
And to obey Thee first of all.

Oh, give me Samuel's heart!
A lowly heart, that waits
When in Thy house Thou art;
Or watches at Thy gates
By day and night—a heart that still
Moves at the breathing of Thy will.

Oh, give me Samuel's mind!
A sweet, unmurm'ring faith,
Obedient and resigned
To Thee in life and death:
That I may read, with child-like eyes,
Truths that are hidden from the wise.

A NAME IN THE SAND

Hannah Flagg Gould was a very popular writer of verse in America about the middle of last century, her themes being chosen chiefly from the lowly life of her country. Her aim was always to illustrate some "moral," as she does very simply and effectively in the following little religious poem.

ALONE I walked the ocean strand;
A pearly shell was in my hand:
I stooped and wrote upon the sand
My name—the year—the day.
As onward from the spot I passed,
One lingering look behind I cast;
A wave came rolling high and fast,
And washed my lines away.

And so, methought, 'twill shortly be
With every mark on earth from me:
A wave of dark oblivion's sea
Will sweep across the place
Where I have trod the sandy shore
Of time, and been, to be no more,
Of me—my day—the name I bore,
To leave no track nor trace.

And yet, with Him who counts the sands,
And holds the waters in His hands
I know a lasting record stands
Inscribed against my name,
Of all this mortal part has wrought,
Of all this thinking soul has sought,
And from these fleeting moments caught
For glory or for shame.

THE BARON'S LAST BANQUET

Albert Gorton Greene was a minor American poet, born in 1802, whose best-known poem is here printed. In spirited verse it retells an old legend of a warrior-baron who had so long overcome his enemies that he could scarce believe his greatest enemy of all, grim Death, had laid hands on him at last, and so drank a vain defiance with his last breath.

O'ER a low couch the setting sun had thrown its latest ray,
Where in his last strong agony a dying warrior lay,
The stern old Baron Rudiger, whose frame had ne'er been bent
By wasting pain, till time and toil its iron strength had spent.

"They come around me here, and say my days of life are o'er,
That I shall mount my noble steed and lead my band no more;
They come, and to my beard they dare to tell me now that I,
Their own liege lord and master born—that I, ha, ha! must die.

"And what is Death? I've dared him oft before the Paynim spear—
Think ye he's entered at my gate, has come to seek me here?
I've met him, faced him, scorned him, when the fight was raging hot—
I'll try his might—I'll brave his power; defy and fear him not.

"Ho! sound the tocsin from my tower, and fire the culverin;
Bid each retainer arm with speed, call every vassal in;
Up with my banner on the wall; the banquet board prepare;
Throw wide the portal of my hall, and bring my armour there!"

A hundred hands were busy then—the banquet forth was spread—
And rung the heavy oaken floor with many a martial tread,
While from the rich, dark tracery along the vaulted wall,
Lights gleamed on harness, plume, and spear, o'er the proud old Gothic hall.

Fast hurrying through the outer gate the mailed retainers poured,
On through the portal's frowning arch, and thronged around the board,
While at its head, within his dark, carved oaken chair of state,
Armed cap-à-pie, stern Rudiger, with girded falchion, sate.

"Fill every beaker up, my men, pour forth the cheering wine;
There's life and strength in every drop—thanksgiving to the vine!
Are ye all there, my vassals, true?—mine eyes are waxing dim;
Fill round, my tried and fearless ones, each goblet to the brim.

"You're there, but yet I see ye not. Draw forth each trusty sword,
And let me hear your faithful steel clash once around my board.
I hear it faintly—louder yet! What clogs my heavy breath?
Up all, and shout for Rudiger, 'Defiance unto Death!'"

Bowl rang to bowl—steel clang to steel—and rose a deafening cry
That made the torches flare around, and shook the flags on high.
"Ho, cravens, do ye fear him? Slaves, traitors, have ye flown?
Ho, cowards, have ye left me to meet him here alone?

"But I defy him—let him come!" Down rang the massy cup,
While from its sheath the ready blade came flashing half-way up;
And with the black and heavy plumes scarce trembling on his head,
There in his dark, carved oaken chair old Rudiger sat—dead!

JESUS, TENDER SHEPHERD

This beautiful little poem is really an evening prayer in rhyme, and was written many years ago by Mrs. Mary Lundie Duncan, the author of "Rhymes for My Children." She is remembered as much for her quiet, useful life as for her poetry, of which she did not publish a great deal.

JESUS, tender Shepherd, hear me,
Bless Thy little lamb to-night;
Through the darkness be Thou near me,
Keep me safe till morning light.

Through this day Thine hand has led me,
And I thank Thee for Thy care;
Thou has warmed me, clothed, and fed me,
Listen to my evening prayer.

Let my sins be all forgiven,
Bless the friends I love so well;
Take me, when I die, to heaven,
Happy, there with Thee to dwell.

A WOMAN'S SHORTCOMINGS

Most of Elizabeth Barrett Browning's poems have a depth of feeling and beauty of rhythm unsurpassed by those of any other woman poet. Although almost all her poetry was written for grown-ups, still a child can enjoy it.

SHE has laughed as softly as if she sighed,
She has counted six and over,
Of a purse well filled, and a heart well tried—
Oh, each a worthy lover!
They "give her time"; for her soul must slip
Where the world has set the grooving;
She will lie to none with her fair red lip—
But love seeks truer loving.

She trembles her fan in sweetness dumb,
As her thoughts were beyond recalling,
With a glance for *one*, and a glance for some,
From her eyelids rising and falling.
Speaks common words with a blushful air,
Hears bold words, unreproving;
But her silence says—what she never will swear—
And love seeks better loving.

Go, lady, lean to the night guitar,
And drop a smile to the bringer;
Then smile as sweetly, when he is far,
At the voice of an indoor singer.
Bask tenderly beneath tender eyes,
Glance lightly on their removing;
And join new vows to old perjuries—
But dare not call it loving.

Unless you can think, when the song is done,
No other is soft in the rhythm;
Unless you can feel, when left by one,
That all men else go with him;
Unless you can know, when unpraised by his breath,
That your beauty itself wants proving;
Unless you can swear "For life, for death!"
Oh, fear to call it loving!

Unless you can muse in a crowd all day,
On the absent face that fixed you;
Unless you can love, as angels may,
With the breath of heaven betwixt you;
Unless you can dream that his faith is fast,
Though behoving and unbehoving;
Unless you can *die* when the dream is past—
Oh, never call it loving!

SUDDEN LIGHT

I HAVE been here before,
But when or how I cannot tell:
I know the grass beyond the door,
The sweet keen smell,
The sighing sound, the lights around the shore.

You have been mine before,—
How long ago I may not know:
But just when at that swallow's soar
Your neck turn'd so,
Some veil did fall,—I knew it all of yore.

Has this been thus before?
And shall not thus time's eddying flight
Still with our lives our love restore
In death's despite,
And day and night yield one delight once more?

D. G. ROSSETTI.

THE MOUSE AND THE CAKE

Already we have read several poems by Eliza Cook, notable in her day as a writer of popular verse of a pure and elevating character. In the following poem from her pen, we have one of the most familiar type of fables, the "moral" of which is so plain that not even the youngest will need to have it pointed out. It is, however, a moral not readily accepted either by old or young, and for that reason there is perhaps good need to keep the little poem in circulation.

A MOUSE found a beautiful piece of plum-cake,
The richest and sweetest that mortal could make;
'Twas heavy with citron and fragrant with spice,
And covered with sugar all sparkling as ice.

"My stars!" cried the mouse, while his eye beamed with glee,
"Here's a treasure I've found. What a feast it will be!
But hark! there's a noise! 'Tis my brothers at play;
So I'll hide with the cake, lest they wander this way.

"Not a bit shall they have, for I know I can eat
Every morsel myself, and I'll have such a treat!"
So off went the mouse, as he held the cake fast;
While his hungry young brothers went scampering past.

He nibbled and nibbled, and panted; but still
He kept gulping it down till he made himself ill;
Yet he swallowed it all, and, 'tis easy to guess,
He was soon so unwell that he groaned with distress.

His family heard him, and as he grew worse,
They sent for the doctor, who made him rehearse
How he'd eaten the cake to the very last crumb,
Without giving his playmates and relatives some.

"Ah me!" cried the doctor, "advice is too late;
You must die before long, so prepare for your fate.
If you had but divided the cake with your brothers,
'Twould have done you no harm, and been good for the others.

"Had you shared it, the treat would have been wholesome enough;
But eaten by *one*, it was dangerous stuff;
So prepare for the worst." And the word had scarce fled,
When the doctor turned round, and the patient was dead.

Now all little people the lesson may take,
And *some* large ones may learn from the mouse and the cake,
Not to be over-selfish with what we may gain,
Or the best of our pleasures may turn into pain.

THE ARROW AND THE SONG

In these famous verses by Henry W. Longfellow, the poet's object is to illustrate a great truth, which, if we but bear it in mind, will very seriously affect our life and conduct. Nothing that we do, nothing that we think or say, though at the time we may not guess the consequence, is done in vain. Just as the arrow shot in the air will somewhere fall to earth, so the deeds we do and the thoughts we express will make their marks perhaps on the lives of others, unseen by us, and will unconsciously affect our own lives as well.

I SHOT an arrow into the air,
It fell to earth, I knew not where;
For, so swiftly it flew, the sight
Could not follow it in its flight.

I breathed a song into the air,
It fell to earth, I knew not where;
For who has sight so keen and strong
That it can follow the flight of song?

Long, long afterward, in an oak
I found the arrow, still unbroke;
And the song, from beginning to end,
I found again in the heart of a friend.

BIRDS IN SUMMER

The following is another of the poetical pieces by Mary Howitt, which were very widely read a generation or more ago. Although it does not rank high as poetry, there is a bright truthfulness in its effort to picture the winged freedom of the birds, and it is certainly worthy of being included in our book. It may be interesting to add that the verses are sometimes attributed to Mrs. Hemans, but we think it is much more probable that they were written by Mrs. Howitt.

HOW pleasant the life of a bird must be,
Flitting about in each leafy tree;
In the leafy trees, so broad and tall,
Like a green and beautiful palace-hall,
With its airy chambers, light and boon,
That open to sun, and stars, and moon;
That open unto the bright blue sky,
And the frolicsome winds as they wander by!

They have left their nests on the forest-bough,
Those homes of delight they need not now;
And the young and the old they wander out,
And traverse their green world round about,
And hark! at the top of this leafy hall,
How one to the other in love they call:
"Come up! Come up!" they seem to say,
"Where the topmost twigs in the breezes sway.

"Come up, come up! for the world is fair
Where the merry leaves dance in the summer air."
And the birds below give back the cry:
"We come, we come to the branches high."
How pleasant the lives of the birds must be,
Living in love in a leafy tree!
And, away through the air, what joy to go;
And to look on the green, bright earth below!

How pleasant the life of a bird must be,
Skimming about on the breezy sea,
Cresting the billows like silvery foam,
Then wheeling away to its cliff-built home!
What joy it must be to sail, upborne
By a strong, free wing, through the rosy morn;
To meet the young sun face to face,
And pierce like a shaft the boundless space;
To pass through the bower of the silver cloud;
To sing in the thunder-halls aloud;
To spread out the wings for a wild-free flight
With the upper cloud-winds—oh, what delight!
Oh, what would I give, like a bird, to go,
Right on through the arch of the sunlit bow,
And see how the water-drops are kissed
Into green and yellow and amethyst!

How pleasant the life of a bird must be,
Wherever it listeth there to flee;
To go, when a joyful fancy calls,
Dashing adown 'mong the waterfalls;
Then to wheel about with their mates at play,
Above and below and among the spray,
Hither and thither, with screams as wild
As the laughing mirth of a rosy child!

What joy it must be, like a living breeze,
To flutter about 'mid the flowering trees;
Lightly to soar, and to see beneath
The wastes of the blossoming purple heath,
And the yellow furze, like fields of gold
That gladdened some fairy region old!
On mountain-tops, on the billowy sea,
On the leafy stems of the forest-tree,
How pleasant the life of a bird must be!

COMMON THINGS

We have had many poems in our book which might have had this heading. The praise of common things, the romance and beauty that dwell in them, and how they may be favorably contrasted with the rich and rare things for which we so often vainly sigh, are very frequent themes with the poets of all lands. These verses, by Mrs. Hawkshawe, do not rank high as poetry, but their good sense is indisputable.

THE sun is a glorious thing,
That comes alike to all;
Lighting the peasant's lowly cot,
The noble's painted hall.

The moonlight is a gentle thing,
It through the window gleams
Upon the snowy pillow where
The happy infant dreams.

It shines upon the fisher's boat,
Out on the lovely sea;
Or where the little lambkins lie,
Beneath the old oak-tree.

The dewdrops on the summer morn,
Sparkle upon the grass;
The village children brush them off,
That through the meadow pass.

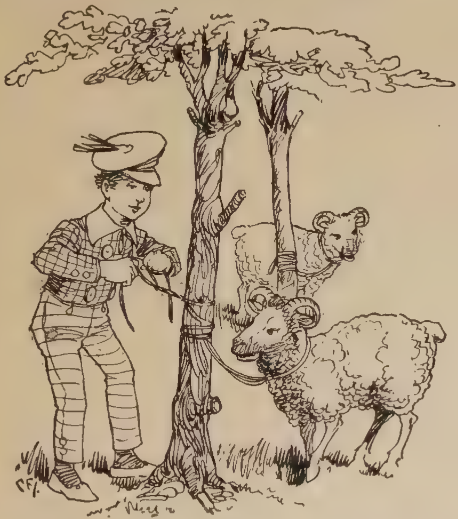
There are no gems in monarch's crowns
More beautiful than they;
And yet we scarcely notice them,
But tread them off in play.

Poor robin on the pear-tree sings,
Beside the cottage door;
The heath-flower fills the air with sweets
Upon the pathless moor.

There are as many lovely things
As many pleasant tones,
For those who sit by cottage hearths
As those who sit on thrones!

LITTLE VERSES FOR VERY LITTLE PEOPLE

TIT-TAT-TOE,
My first go,
Three jolly butcher-boys
All in a row;
Stick one up,
Stick one down,
Stick one in the old man's crown.



THOMAS À TATTAMUS took two T's
To tie two tups to two tall trees,
To frighten the terrible Thomas à Tattamus!
Tell me how many T's there are in all that.

I HAD a little boy,
And called him Blue Bell;
Gave him a little work,
He did it very well.

I bade him go upstairs
To bring me a gold pin;
In coal-scuttle fell he,
Up to his little chin.

He went to the garden
To pick a little sage;
He tumbled on his nose,
And fell into a rage.

He went to the cellar
To draw a little beer;
And quickly did return
To say there was none there.

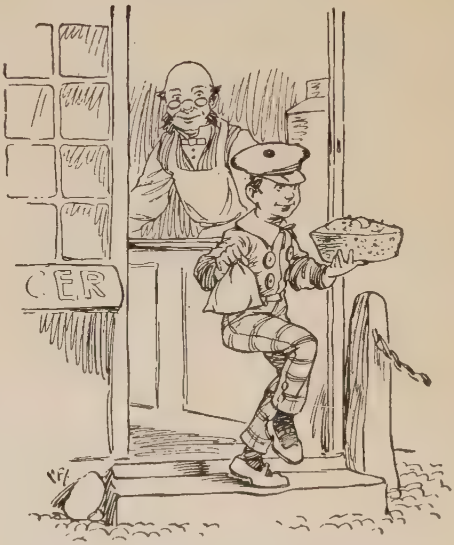
BIRDS of a feather flock together,
And so will pigs and swine;
Rats and mice will have their choice,
And so will I have mine.

THERE was a little man,
Who wooed a little maid;
And he said: "Little maid, will you wed, wed, wed?
I have little more to say,
So will you ay or nay?
For the least said is soonest men-ded, ded, ded."

Then the little maid replied:
"Should I be your little bride,
Pray what must we have for to eat, eat, eat?
Will the flame that you're so rich in
Light a fire in the kitchen?
Or the little God of Love turn the spit, spit, spit?"

GO to bed first,
A golden purse;
Go to bed second,
A golden pheasant;
Go to bed third,
A golden bird.

THERE was an old man,
And he had a calf,
And that's half;
He took him out of the stall,
And put him on the wall,
And that's all.



HANDY PANDY, Jack-a-Dandy,
Loves plum-cake and sugar-candy;
He bought some at a grocer's shop,
And out he came, hop, hop, hop.

NURSERY RHYMES OF CHILDREN OF FRANCE

EVERY country has its own nursery rhymes, for little folks must be amused with merry or quaint verses, though they are English, French or German. And nursery rhymes are very much alike all the world over, so far as their ideas are concerned, even if their words look like none we have ever seen in print or heard before. Here are three pretty nursery rhymes in French, with English versions of the same. So many boys and girls know French that many of our readers may be able to understand the rhymes in the original language; but it is not easy to turn the French rhymes into English rhymes, and preserve the original meaning, but this has been done very cleverly in those here printed.

LA BERGÈRE

IL était une bergère
Et ron, ron, ron, petit patapon.
Il était une bergère
Qui gardait ses moutons,
Ron, ron,
Qui gardait ses moutons.

Elle fit un fromage
Et ron, ron, ron, petit patapon.
Elle fit un fromage
Du lait de ses moutons
Ron, ron,
Du lait de ses moutons.

Le chat qui la regarde
Et ron, ron, ron, petit patapon.
Le chat qui la regarde
D'un petit air fripon
Ron, ron,
D'un petit air fripon.

Si tu y mets la patte
Et ron, ron, ron, petit patapon.
Si tu y mets la patte
Tu auras du bâton,
Ron, ron,
Tu auras du bâton.

Il n'y mit pas la patte,
Et ron, ron, ron, petit patapon.
Il n'y mit pas la patte
Il y mit le menton,
Ron, ron,
Il y mit le menton!

THE SHEPHERDESS

A DAINTY shepherd maiden,
And cheep, cheep, cheep, little patapeep.
A dainty shepherd maiden
Was watching by her sheep,
Cheep, cheep,
Was watching by her sheep.

She made a lovely cheese once,
And cheep, cheep, cheep, little patapeep.
She made a lovely cheese once
Of milk from her kind sheep,
Cheep, cheep.
Of milk from her kind sheep.

Her cat looks up demurely,
And cheep, cheep, cheep, little patapeep.
Her cat looks up demurely,
Then quick pretends to sleep,
Cheep, cheep,
Then quick pretends to sleep.

Don't dare put in your paw, Puss,
And cheep, cheep, cheep, little patapeep,
Don't dare put in your paw, Puss,
Or you'll not be let off cheap,
Cheep, cheep,
Or you'll not be let off cheap.

Good Pussy kept her paw out,
And cheep, cheep, cheep, little patapeep.
Good Pussy kept her paw out,
But dipped her chin in deep,
Cheep, cheep,
But dipped her chin in deep.

RAMÈNE TES MOUTONS

LA plus aimable à mon gré
Je vais vous la présenter.
Nous lui ferons passer barrière.
"Ramène tes moutons, bergère;
Ramène, ramène, ramène, donc,
Tes moutons à la maison."

BRING BACK YOUR SHEEP

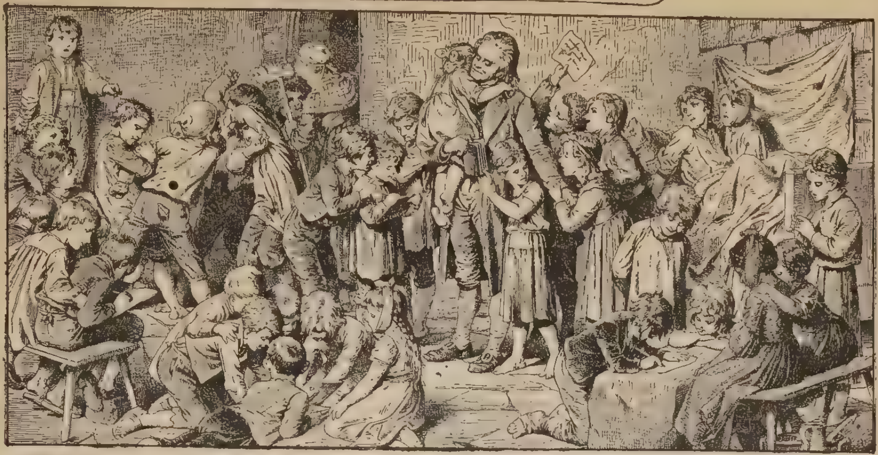
I'LL introduce—just wait awhile—
A charming maiden by yon stile.
"Ho! pass this way," aloud we'll mock;
"Shepherdess, lead back your flock;
Lead back, lead back, as you are told,
Your pretty sheep within the fold."

LES PETITS BATEAUX

"PAPA, les petits bateaux,
Qui vont sur l'eau,
Ont-ils des jambes?"
"Mais oui, petit bêta,
S'ils n'en avaient pas.
Ils ne marcheraient pas!"

THE LITTLE BOAT

"DAD, has a boat,
Sailing afloat,
Got two legs like me?"
"Yes, little zany,
If it hadn't any,
It couldn't move, you see!"



THE MAN WHO LOVED CHILDREN

CONTINUED FROM 4091

SCHOOL is a very bright and pleasant place in these days, and boys and girls are happy when they are at school; but this was not always the case. A hundred years ago most schools were dull and gloomy, and there was no attempt to make the lessons so bright and interesting that children would look forward to them.

But here and there was a man who believed that lessons could be given in such a pleasant way that boys and girls would really love to be at school. One of these men was a Swiss named John Pestalozzi, and we all owe a great deal to him and to the way in which he gave his time and money and whole life for the great purpose he had at heart.

Pestalozzi loved children, and when he saw the misery in which most of the poor boys and girls of his native land lived, he determined to do something to help them to grow up good and useful men and women. He bought a farm, built a large dwelling-house, collected fifty of the very poorest boys he could find in the roads and lanes, and took them to live with him in his house, and taught them farming.

But Pestalozzi was not a very clever business man, and at the end of five years he had spent all his own and his wife's money in helping others, and had to give up the farm. But he had done a great deal for boys and girls, for he had shown that very poor children could be educated and trained to work, and though his own school failed, industrial schools similar to his are now found in every country. But it was not only his money that Pestalozzi gave freely to help boys and girls—he gave his whole life up to them. In 1798 the French army acted very cruelly in the canton of Unterwalden, and many poor children lost their parents. Pestalozzi at once left his family, and, gathering eighty of the poorest children into an old convent, taught them, played with them, and did everything he could to make their lives happy.

From morning to evening he was alone with them; everything they needed was provided by his hand; every help in time of need and all their teaching came from him. "My hand lay on their hand," he tells us, "my eye rested on their eye, my tears flowed with theirs, and my laughter accompanied theirs. They were with me and I was with them. Their soup was mine, their drink was mine. I had nothing—no housekeeper, no friend, no servants around me; I had them alone. Were they well, I stood in their midst; were they ill, I was at their side. I slept in the middle of them. I was the last who went to bed at night, the first to rise in the morning. Even in bed I prayed and taught with them until they were asleep—they wished it to be so."

The picture on page 4191 shows how Pestalozzi gave himself up to the children, and how they loved him. But his life was full of disappointments, and after a year the convent was wanted by the French troops for a hospital, and the school was again broken up. Pestalozzi's life of love and self-denial was not lost. His work lives to-day in the many industrial schools for the poor, where boys and girls are taught useful trades that will fit them for the battle of life, and his labors are still bearing fruit in the better and more natural methods of teaching which are now found in every civilized country in the world.

THE BOY WHO SAVED THE BOAT

A BRITISH warship, the Seringapatam, was anchored one August afternoon off Antigua, one of the Leeward Islands of the West Indies. The weather was fine and the sea calm, and so some of the officers thought a little cruise in the pinnace to a bay two miles distant would be a nice excursion.

The plan was carried out, and a pleasant afternoon was spent. All went well on the return voyage until the wind died down and becalmed the pinnace.

Then suddenly, without any warning, a hurricane burst forth with all the fury known in the West Indian Seas. A gust of wind overturned the boat, and all on board were thrown into the raging sea.

One by one they managed to swim to the gunwale of the overturned boat and cling to the sides. Their position was dangerous, as the boat was slowly drifting out to sea. Any moment the storm might break in all its severity; and worse than all that were the dreaded sharks in the waters around.

Among the officers was a brave young midshipman, named Smith, who astonished his companions by declaring that he would swim ashore to get help.

"What!" they cried. "Swim two miles in this sea, with sharks all around?"

"Yes," he persisted. "There is no other chance. Will one of you go with me? I believe I can do it."

But the men kept silence.

Then Smith's fellow midshipman, Palmer, not to be outdone in bravery, and unwilling to let his friend risk his life alone, though he was not a very rapid swimmer, and far from strong, said that he would make the attempt.

So the two boys cast off their shoes, caps, and jackets, and, taking leave of their companions, plunged into the sea and struck out for the shore.

At first they made good progress, but soon it was apparent to the men watching them that Smith was making greater headway than Palmer. All the time Smith was on the look-out for sharks, and at last, down in the deep clear water below him, he saw two particularly large ones swimming along.

When the boys had covered about half the distance, Palmer, whose strokes had been getting weaker, called out:

"I'm done. Go on, Smith."

But Smith was not the boy to desert a plucky friend; instead, he urged him to rest an arm on his shoulder awhile.

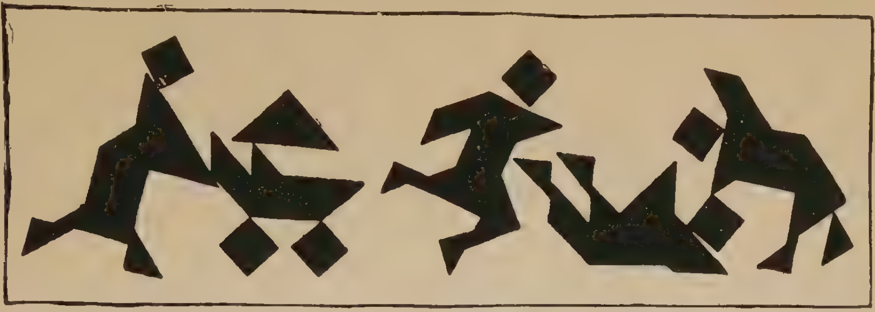
This Palmer did, and so got relief, though both boys continued to use their feet, lest the sharks should be after them. These creatures were plainly visible now, but, possibly because the boys wore dark suits and continued moving all the time, they were not attacked. The stronger boy did all he could to keep up the spirits and strength of his friend, who was by this time almost exhausted.

The last few yards were very difficult, but just in time, and after swimming for two hours, Smith felt ground under his feet, and dragged his helpless companion up on to the beach.

They were safe, but there were the men in the boat still to be rescued. Smith ran to the nearest village and two boats were manned and sent out, but by this time it was nearly dark and rain fell in torrents, so that hours were spent in searching for the overturned pinnace. Boats were also launched from the Seringapatam to find it, and at last it was discovered six miles away.

The two brave boys were presented with silver medals by the Royal Humane Society, and some time after Smith gained another medal for rescuing two men who fell overboard.

THE NEXT GOLDEN DEEDS ARE ON PAGE 4357.

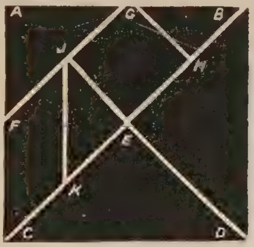


THE LITTLE BLACK TANGRAMS

CONTINUED FROM 4047

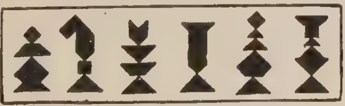
TANGRAMS are little black cards of various shapes that are supposed to have been first designed in China many centuries ago. Any boy or girl can make a set of tangrams by taking a square of black card and cutting it up into seven pieces as shown in the picture on this page.

Cardboard that is black on both sides can be bought at most stationers', but if there is any difficulty we can ourselves make the card black by coloring it with ink, or by pasting over ordinary white card a piece of black paper. It is not absolutely essential that the card should be black; any other dark color does fairly well, although it must be acknowledged that black is really best for the purpose for which tangrams are used—it shows up so well.



How to cut the tangrams.

To cut the tangrams, we take a square of card, and this may be of any serviceable size—say, three inches square. We cut, with a sharp penknife, from C to B. Then we find the middle point of C B, which is E, and cut from E to D. The remaining pieces are easily cut to the right sizes, for the various points to and from which we cut are all the middle points of lines. Thus, G is the middle of A B, F of A C, J of F G, K of C E, H of E B. Having cut the square up as shown, we have seven pieces of card of varying size—two large triangles, two small, one of medium size, a square, and a rhomboid, F C K J. The card should be black on both sides, so that this latter piece may be used on either of its sides.



Chessmen made from tangrams.

By putting these seven pieces of card together, there is scarcely anything that we cannot make with the little black tangrams. It must be understood that in each picture every one of the seven pieces of card has to be used; and we must let the whole of each piece of card be completely seen—that is, we must not put one piece partly over another. That pictures of thousands of objects, in fact, of anything, can be made with these seven little pieces of card seems impossible, but it is a fact. Take, for instance, the picture at the top of this page, showing children at play.

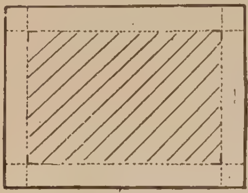
Each individual in the group is made up from one set of tangrams, and the baby-carriage is also made up from one set, so that the whole group of four children and the baby-carriage can be made out of five sets of tangrams, one set being used complete for each figure. Then, again, in the picture of chessmen, each particular chessman is made of one complete set of tangrams. These are only a few examples of what can be done with the tangrams. We can make men, animals, birds, fishes, flowers, boats, houses, shoes, lanterns, faces, geometrical figures, and so on. It is not always easy, even with a finished tangram picture in front of us as a pattern, to put the tangrams together properly to produce the picture, and we may try it with the examples given in this page. Every one of these can be made up exactly from a set of tangrams.

Even artists have declared it quite impossible to form certain figures and objects out of tangrams, and when they have afterwards been shown how these can be made up, they have expressed great wonder at the possibilities in tangrams. Even the letters of the alphabet can be made quite well, a complete set being used for each letter. With a few sets of tangram cards, endless fun and amusement, together with healthy intellectual exercise, can be obtained, and the more one uses these cards for picture-building, the more fascinating they seem to be. To entertain a company, we should supply each person with a number of sets of tangrams and award a prize to the one whose picture is decided to be the best.

PICTURE-FRAMES FOR THE SCHOOLROOM

WE are going to learn how to make frames for little pictures or photographs, so that we can hang them up and become the possessor of a small picture-gallery of our very own.

It often happens that we have a dear little picture on a Christmas card or on a picture postcard, or a snapshot of a friend, that we should like to keep. But we cannot possibly manage a frame out of our pocket-money, and so the poor little picture has to stay on the mantelpiece till its corners are curled up and the front becomes soiled and dirty. Picture 3 on this page shows a little frame just suitable for such a purpose, and quite easy to make.



1. The mount.

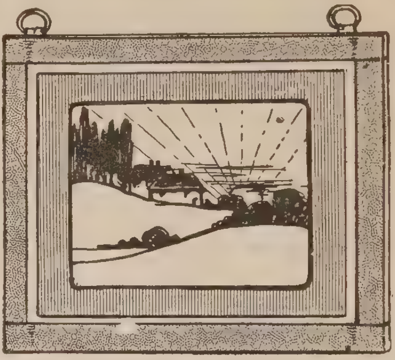
These are the things we shall need:

1. A few old photographic plates or squares of glass. A box of honey usually has glass sides which are about the right size for your purpose.

2. A piece of inch-wide black tape, and a piece of the narrowest width as well, both of these costing two cents.

3. One dozen small brass rings, costing five cents. We should buy a very small size—just a little larger round than a black lead pencil.

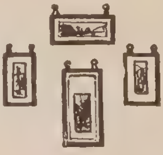
4. Some strong paste. The kind called "Library Paste" is by far the best, because it is not at all sticky to use and yet fastens things such as paper and cardboard exceedingly tightly.



3. Picture on brown paper, with white mount.

5. Some white paper, a pencil, ruler, ink, and penknife.

Now we can make a start. We must take two old plates of the same size and wash off the film—that is, the jelly-like substance on one side of the glass on which the actual photograph has been taken. If we use *warm* water it will slide off the glass at once, leaving it quite clear and clean. We must polish the glass with a duster, and then, when there is not even the least little smear left, the glasses are ready for use.

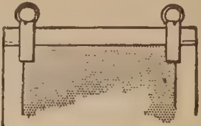


4. How to arrange the pictures.

Now we must find our little picture and cut it to fit the size of our plate, or it can be a little smaller. The two pieces of glass are going to form the front and back of our picture; the picture itself will go in between, and the black tape is going to make the frame to hold it all together. The *mount* makes a border round the picture, and is also useful for filling in the space if the picture should happen to be a very small one.

We must take our little picture and put a small dab of paste on each corner at the back; lay it on one of the pieces of glass and press it down. Then we put a book on top for a little while to keep it flat.

The next thing to do is to make a mount—that is, the little border which shows in between a picture and its frame. For this we cut a piece of white or cream paper the same size as our glass; cartridge drawing-paper at two cents a large sheet is the best. This is easily done by laying the glass on the paper, marking round the edges with a pencil, and cutting out along the lines with scissors or a penknife. We place this paper on the table and carefully rule, in faint pencil-lines, a small border all round, about three-quarters of an inch away from the edge. This leaves a square in the middle; we cut this out very carefully with a penknife and ruler, and we have then got our mount ready to lay over the picture which is stuck to the glass.



2. The rings.

If we look at picture 1, this will be quite clear. We fix the mount to the picture in the same way, by small dabs of paste, and then lay the other glass on top of all. This must be kept in place, too, by paste, but we must be very careful to keep the paste near the edges, so that it will not show when the frame comes on.

The frame is put on next. For this we must cut four pieces of tape, each a little longer than the sides of the glass we are using, cover one side of the tape with paste, and then stick the tape on evenly all round the edge of the two glasses, letting half the width show in front.

We must be quite sure to put the top and bottom on first, and then cut off quite evenly the pieces which are left sticking out. We must put the sides on afterwards, then cut off the extra tape, and smooth down the edges with a little paste, pressed on firmly with the finger.

When the four sides are on, we should put the frame under the book again to press for an hour or so, and then fix on the rings by which it is hung up.

Through each ring we pass a piece of the narrow tape, about two inches long. We then paste the two ends firmly behind the picture, as shown in picture 2, and the frame is complete.

When we have mastered these directions, we shall be able to make more elaborate mounts, because the picture can be improved by the kind of mount we put round it. Brown paper makes nice mounts to photographs, particularly if decorated with a black ink border. Picture 4 shows how the frames may be arranged on the wall.

HOW TO KEEP A SECRET IN WRITING

IT is a wise and safe rule that if you want to keep a secret you must never write it down; but it is easy to write a secret so that nobody but yourself or your friend can read it.

Not many years ago, when a terrible thing happened in Russia, the Russian Government did not want the news of it to reach other countries, and they stopped all telegrams about it. But a clever journalist knew how to beat the Government, and he sent long telegrams to a merchant in Liverpool all about corn. It seemed very uninteresting and unimportant to the telegraph clerks in Russia, but when the merchant received the telegrams in Liverpool he knew that the Emperor of Russia was dead. The journalist had written his telegrams in a mystery-language which he and the merchant understood. You may make a mystery-language of your own. You have read of codes, and messages, and secret ciphers in times of war. A cipher is a way of writing, in any language, in such a way that even those who know the language cannot understand the writing unless they have the key which makes it clear. There are many simple ciphers which we can quickly learn; those used in time of war are, of course, very difficult.

This sentence would puzzle some boys and girls if they saw it in a book: "Ihopeyoucanreadthis," but it is really only six words joined together.

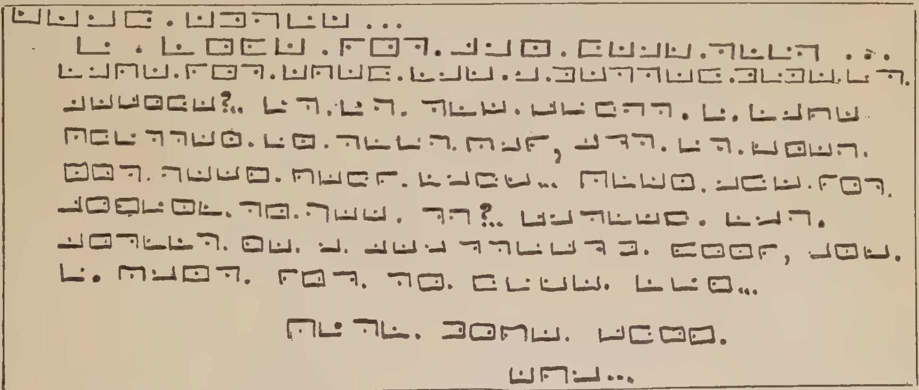
That is the simplest kind of cipher you can have, and of course it is not really a cipher at all. Here are some others, three letters written in different ciphers. The first looks like a Chinese puzzle, but the key will show you how easy it is.

Extraordinary as this seems, it is really very simple when you have the key to the cipher in which the letter is written. The alphabet is divided up so that it is possible to indicate the position of any one letter by a dot, as is seen here:

a b c	d e f	g h i
j k l	m n o	p q r
s t u	v w x	y z

You will notice that there are three letters of the alphabet in each space, except the last. To write the key, begin with the first letter in the first space, then write the alphabet *across* the rows of spaces. Next you must notice the position of each letter in each space; for instance, *a* is the *first* letter in the space marked by the lines __|. Thus, instead of writing *a*, you write .__|, being careful to place the dot in the *first position* in the space. In the same way *b* is written _._|, where the dot is in the *second position*. The letter d is the first dot in the second space, thus: |.__|, *e* is |_._|, and so on for the remainder of the letters. Instead of using dots the figures 1, 2, 3 may mark positions, so that *a* would be 1__|, *b* _2_|, *c* __3|, and so on; but the dot system is better and more puzzling. When writing a letter in this way, remember to *put a full stop after each word* and *three stops at the end of each sentence.* Always take care that these stops come *outside* the space. The comma and other marks may be used as usual.

Now that you have the key you will be able to read the cipher letter which says:



DEAR ELSIE,

I hope you can read this. Have you ever had a letter like it before? It is the first I have written in this way, but it does not seem very hard. When are you coming to see us? Father has bought me a beautiful pony, and I want you to ride him. With love from EVA.

Here is another cipher—a letter in figures:

13.2.1.43—2.51.1—
45.23.2—21.3.43.44.45—41.1.43.45—
4.21—54.4.5.43—33.2.45.45.2.43—
45.4.4.32—34.2—1—33.4.35.22—
45.3.34.2—45.4—43.2.1.13, 11.5.45—3—
44.4.4.35—11.2.22.1.35—45.4—
32.35.4.52—45.23.2—33.2.45.45.2.43.44—
52.3.45.23.4.5.45—5.44.3.35.22—
45.23.2—32.2.54... 3—1.34—
12.4.34.3.35.22—45.4—44.2.2—54.4.5—
3.35—45.23.2—23.4.33.3.13.1.54.44—
3.21—3—12.1.35...
52.3.45.23—33.4.51.2—21.43.4.34—
2.33.44.3.2.

To get the key of this cipher, write out the alphabet in this way, numbering the five vowels in order:

a b c d e f g h i j k l m n o p q r s t u v w x y z.
1 2 3 4 5

Thus, a is 1; e is 2; i is 3; o is 4; u is 5.

To find any other letter, we must get first the number of the vowel before it, then count the number of letters after the vowel until we reach the letter we want. Thus, *b* comes after the *first* vowel, and is the first letter after it; and instead of *b* we write 11—the first figure for the number of the vowel, the second for the number of the letter past the vowel. In the same way, *c* is 12—that is, the second letter past the first vowel; *f* is 21—that is, the first letter after the second vowel. We must be very careful, of course, to put the number of the vowel in its proper place.

We can now write the whole alphabet in figures according to our cipher:

a,	1	e,	2	i,	3	m,	34	q,	42	u,	5	x,	53
b,	11	f,	21	j,	31	n,	35	r,	43	v,	51	y,	54
c,	12	g,	22	k,	32	o,	4	s,	44	w,	52	z,	55
d,	13	h,	23	l,	33	p,	41	t,	45				

In writing this cipher, *put a full stop after each letter*, and *a short line at the end of each word.* Finish a sentence with three full stops; use commas and other stops as usual. You will now be able to read the figure-letter in ordinary writing. Here it is:

Dear Eva,

The first part of your letter took me a long time to read, but I soon began to know the letters without using the key. I am coming to see you in the holidays if I can. With love from Elsie.

The third cipher may seem more puzzling still at first sight, though it has a great drawback which may often destroy its value.

Deeeeayare Eeellesseyeee,

Doubleyouee aitchaydee essyouseaaitch effyouen ohveeeeare teaaitchee elleeteateaeeare wyohyou esseeentea. Jayayseakay teaaitcheyeenkayess wyohyouare seaeyepeaaitcheeare eyeess veeeearewy geeohohdee. Eye ayem jayyouesstea geeoheyeengee ohyoutea ohen emwy peaohenwy, essoh geeohohdee-bewyee.

Doubleyoueyeteaaitch ellohveeee effareohem Eeveeay.

If you will read this letter aloud, the mystery will become clear to you. The secret of it is that every letter is spelled. Some letters of the alphabet can be spelled in more than one way, but it does not matter which we choose if we keep the same throughout our letter.

The key to our spelling here is:

a,	ay	h,	aitch	o,	oh	u,	you
b,	be	i,	eye	p,	pea	v,	vee
c,	sea	j,	jay	q,	cue	w,	doubleyou
d,	dee	k,	kay	r,	are	x,	ex
e,	e	l,	ell	s,	ess	y,	wy
f,	eff	m,	em	t,	tea	z,	zed
g,	gee	n,	en				

In ordinary writing, the letter reads:

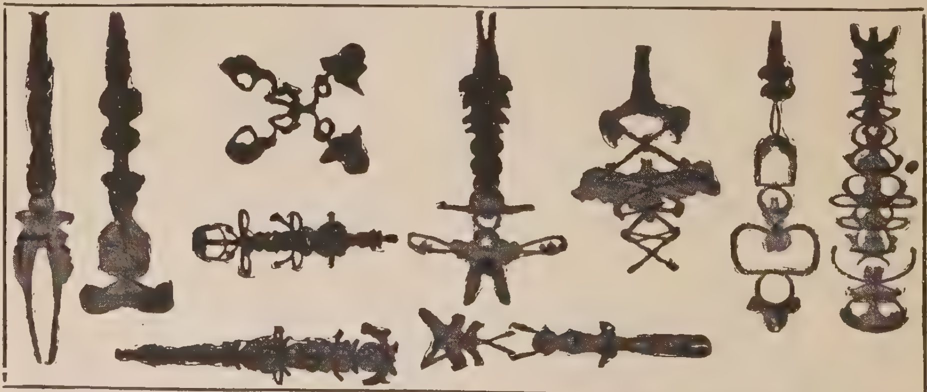
Dear Elsie,

We had such fun over the letter you sent. Jack thinks your cipher is very good. I am just going out on my pony, so good-bye. With love from Eva.

These examples of mystery-writing will give you great amusement if you practise them, and you will find that to invent new ciphers for yourself is very simple now that you have learned to understand these.

NAME-PICTURES AND HOW TO MAKE THEM

MAKING name-pictures, or "smudge-graphs," is a very pretty amusement. We want some paper, pens, and ink, and must sit up to the table. Dip the pen in the ink and scribble quickly a fairly thick zigzag line on the paper; then, before it gets dry, fold the paper over at the side of the scribbled line, and rub it down with the thumbnail. On opening it again, a pretty outline will be seen. Names or words may be written instead, and the paper folded just at the base of the letters. Quite pretty ornamentations can be made like this, even by people who are not able to draw. Fold the paper *first* and use the fold to write against, as you use the lines in exercise books. Sometimes better effects are made by folding the paper through the middle of the word instead of by the side of it.



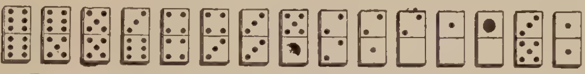
PICTURES MADE BY FOLDING OVER SMUDGES, ZIGZAG LINES, CROSSES, AND NAMES

TRICKS WITH A SET OF DOMINOES

MOST of us possess a box of dominoes, but few, probably, ever thought of using them for conjuring purposes. As a matter of fact, however, a set of dominoes, in the hands of a smart boy, will enable him to perform two or three capital tricks that will cause much wonder among the audience.

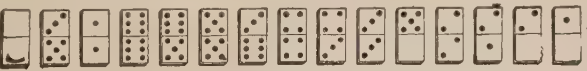
To begin with, he may invite someone to pick out any domino he pleases, and after noticing its points, hold it hidden in his hand. He is then to multiply the points at either end of the domino by two, add five to the product, multiply the total so obtained by five, and add the points at the opposite end. On his stating the final result, the young wizard will tell him what domino he chose.

In order to ascertain this, all that he has got to do is to subtract twenty-five from the number given him, when the remainder will consist of two figures, corresponding with the two ends of the domino. Thus, suppose that the points were six, three. Twice 6 are 12; 12 and 5 are 17, and 5 times 17 are 85. The addition of the 3 points at the other end of the domino brings the total up to 88. This is, therefore, the number which is told to the performer. Subtracting 25 from 88, the remainder is 63, the two digits, 6—3, supplying the desired answer. Whichever end of the domino we begin with, it comes to the same thing. Suppose we begin with the 3 instead of the 6. Twice 3 are 6; 6 and 5 are 11; 5 times 11 are 55, and 55 and 6 make 61. Twenty-five taken from 61 leave 36, again giving the points of the domino, but this time in the reverse order, 3—6.



1. The row of dominoes arranged ready for the trick to be performed.

After repeating the trick once or twice, we proceed to a feat of a different kind. We lay fifteen of the dominoes in a row face downwards on the table, taking them apparently haphazard, but really choosing particular numbers, as follows: The first domino, at the left-hand end of the row, must be the double six; the next a six-five; the third either a six-four or a double five—either of these making a total of ten; the fourth a six-three or five-four—to make nine; the fifth any domino that will show a total of eight, and so on with dominoes making seven, six, five, four, three, two, and one respectively. The thirteenth domino must be the double blank, after which we complete the row with any two other dominoes we please. The fact that the dominoes are placed in this particular order is, of course, unknown to the spectators, and we must not let them see us choosing the numbers.



2. The row of dominoes as it appears after some have been moved.

We now invite anyone to shift any number of the dominoes from the right to the left-hand end of the row. While he does so we leave the room, assuring him that though we cannot see what he does, we shall know, notwithstanding, how many dominoes he moves. On our return we say: "Yes, I can tell you how many you have moved. In fact, the dominoes shall tell you themselves. I will turn up the very domino giving the correct answer." We turn up one domino, and its points are found exactly to agree with the number that has been shifted.

As a matter of fact, we do not ourselves know the number moved, but we must not let the audience suspect this. The secret lies in the fact that *the third domino from the right-hand end of the row* will always be the same as the number moved. Let us take an example. Say that the dominoes, or stones, as they are called, are, at starting, as shown in our first picture, save that they will be faces down instead of up. Suppose that three are shifted. The row as thereby altered would then be as in our second picture. We can see that the third from the right is the two-one, representing three. If four stones had been moved, the third from the right would have been a four, and so on. By way of a third trick we may next challenge anyone to arrange the whole of the stones in proper domino fashion; six against six, five against five, and so on. We show in the first place, by doing it, that it can be done. "It looks easy, doesn't it?" we remark. "But now I shall put a spell upon the dominoes, and while the charm lasts nobody but myself can do it." We mix up the stones, and now anyone may try, but he will try in vain.

The secret in this case is that in shuffling the dominoes we privately take away any two of them, *all four ends of which are different*, when the rest can no longer be arranged in a continuous row.

To conclude, we again wave our hand over the dominoes, and secretly put back one of those taken away. "Now," we say, "I will take off the charm, and you will find that you can arrange the dominoes quite easily. While you are doing so, I will leave the room. When you have finished, cover the dominoes over with a handkerchief, and I will tell you, without seeing them, the number at each end of the row." Which you do accordingly.

Here, again, the solution is simple enough. A complete set of dominoes, twenty-eight in number, may be arranged domino fashion in a complete circle or chain. If we remove any one stone, not being a double, there will be a break in the chain, and the numbers on each side of the break will be the same as those of the stone we removed. For instance, if we have abstracted a five-three, the number at the one end of the row will be a five, and the number at the other end a three. Whether the stones are actually arranged in a circle or in a straight line makes no difference. These are a few of the tricks that it is possible to do with dominoes, which may be made extremely interesting, and which will be sure to mystify the onlookers.

HOW TO MAKE PAPER FLOWERS

PAPER flowers are easily made at very little cost, and if they are well modeled, and the colored paper of which they are made is carefully chosen, it is difficult to distinguish them from the flowers they represent.

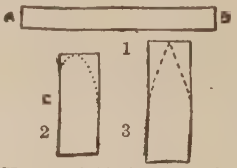
Artificial flowers are very useful for table decoration; they can be used with excellent effect as sprays for lamp-shades, and, of course, they are always in great demand at bazaars.

ROSES

Let us first consider roses, for which we need only some colored paper and a little wire. Any stationer will supply us with colored crêpe paper at 10 c. a roll, and we can buy a reel of fine wire from a florist's.

Take a strip of colored crêpe paper—red or pink or yellow—about thirty inches long and three inches wide. Fold it in half, as from A to B in picture 1, again fold in half in the same direction, then fold it in three equal parts, and once again into two equal parts. If we count, we shall find that the paper is now twenty-four thicknesses.

Take a pencil and mark as shown by dotted line in picture 2, taking care that the folded side, and not the outside edges, is in the position of C. Cut round this line with scissors and open out the paper, which will now show twelve petals. Now with one of the blades of the scissors we must *curl the edges of each petal.* To do this, hold the paper in the left hand, and with the scissors between the thumb and first finger of the right hand gently pass the blade under the petal, first curling the right side and then the left, but always curling in the same direction. Now gather the first four petals closely together and gradually gather the others round and round these.



How to fold the paper in making the rose.

Next we must make the *calyx* of the rose—that is, the little green leaves forming a cup at the base of the flower-head. Take a piece of green crêpe paper, three inches by two inches, fold it in half and then in the same direction into three equal parts. Cut as shown by dotted line in picture 3. This makes six points when opened out; cut off one, as we require only five; wrap the calyx round the outside rose-leaves and fasten with a small piece of wire. All that remains to be made now is the flower-stalk. Take a strip of green crêpe paper, seven or eight inches long and half an inch wide, and a piece of wire four and a half inches in length. Cover the wire with the green, holding the paper in a slanting direction in the left hand and gradually turning the wire with the right hand until covered. Double up one end of the stalk for about an eighth of an inch, and fasten the other end of the flower-head, and our flower is quite complete. Leaves for the rose can be bought at the shops quite cheaply.

CHRYSANTHEMUMS

To make a chrysanthemum we must take a piece of yellow tissue-paper forty inches long and five inches wide; fold it in half lengthways—that is to make a double strip forty inches long and two and a half inches wide; then with a pair of scissors cut a fringe about one and a quarter inch deep right along the strip, beginning from the folded side, not the outside edges.

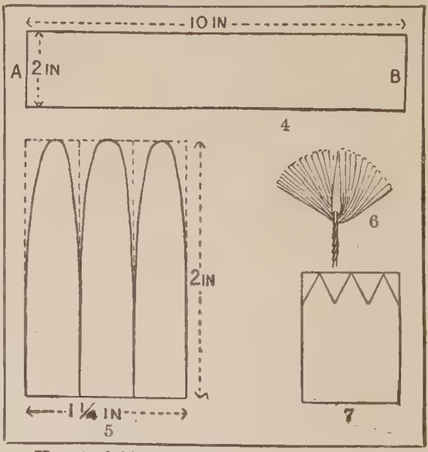
Now hold the paper in the left hand, and with the right hand take the end of the paper and wind round and round as explained above. Prepare the stalk as is shown in making the paper rose, and fasten it very firmly round the base of the flower.

YELLOW MARGUERITES

Marguerites are not quite so easy to make. Take a strip of yellow tissue-paper, ten inches long and two inches wide; fold in half, as from A to B in picture 4; fold again in the same direction, and still again, making the paper eight thicknesses.

Now take a pencil and draw three petals, as shown in picture 5. Cut with scissors and open out paper, which will now show twenty-four petals.

We have now to make the centre of the marguerite, for which we must get some yellow crewel wool, a few shades deeper in color than the paper; about three yards will be sufficient. Wind this round three fingers of the left hand, and fasten a small piece of wire round the centre of the loops, leaving a small end, as shown in picture 6. Bring the ends of the wool together and then cut the edges.



How to fold the paper for the marguerite.

Next take a piece of green paper, three inches long and one inch wide, to make the calyx of the flower. Fold this in half; again fold in half, and cut out three peaks, as shown in picture 7.

Now take the long strip of yellow paper, double it, and gather the petals round the wool centre; wrap the green calyx outside this, and fasten with the end of the wire stalk, which should previously have been covered with green crêpe paper, as explained in making the paper rose. Arrange the petals carefully with the fingers, and the flower is finished.

This flower needs a little practice to make, but the result will amply repay the worker.

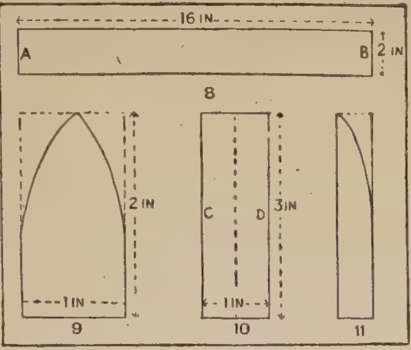
DOUBLE YELLOW DAFFODILS

We are now going to make a double daffodil. Cut a strip of yellow tissue-paper, sixteen inches long and two inches wide, and fold in half, as from A to B in picture 8; fold again three times in the same way, making the strip sixteen thicknesses. Take a pencil and mark the outline of petal as in picture 9. Cut with scissors, open out the paper, and curl the edges of each petal slightly by holding one of the blades of the scissors between the thumb and first finger of the right hand, and gently passing underneath the paper petal.

Now take a strip of paler colored yellow paper, six inches long and two and a half inches deep, and fold into eight pieces—that is, by folding in half three times; mark and cut outline of petal as shown in picture 9.

Gather the first four petals of the sixteen-inch strip together, and arrange the other petals round them; then take the paler colored piece and gather round this, and fasten all securely together with the end of the green covered wire stalk. Have you ever noticed that in the daffodil there is always a little brown, dried-up-looking leaf growing near the flower-head? We have now to make this little leaf from a small piece of light brown tissue-paper, one inch across and three inches deep. Fold it in half, as from C to D in picture 10, and cut as marked in picture 11, beginning to cut from the outside edges. Open out the leaf and fasten with some green covered wire to the stalk a little way below the flower-head.

All that we now require is just a few green leaves to arrange with our daffodils. These are easily made from a strip of green crepe paper seven inches long and one inch wide, folded and cut in exactly the same way as we have just done for the brown leaf.

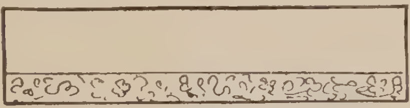


How to fold the paper for the daffodil

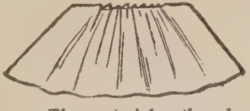
If we have followed these instructions intelligently, we shall have no difficulty in copying any other flower that pleases our fancy.

A BONNET FOR A BABY DOLL

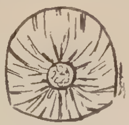
IF you have a baby doll, here is a pretty little bonnet made of a straight piece of material, as shown in picture 1. It is gathered on one side about a quarter of an inch from the edge as shown in picture 2, leaving a straight piece on each side. When the thread is drawn quite tight just as it has been drawn in picture 2, join together the two little straight pieces which you have left on each side of the gathers, and you will have the little round shape shown in the next picture (3), which is the back of our bonnet.



1. The pattern of the bonnet



2. The material gathered

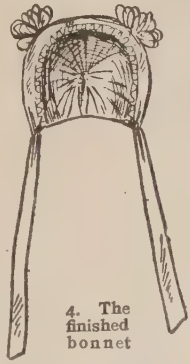


3. The back of the bonnet

On each point of the front a ribbon should be sewn to fasten the bonnet under the chin.

To trim the little bonnet, put a flat piece of lace over the front edge of the bonnet, as shown in picture 1, while a tiny ruche, or frilling, of Valenciennes lace sewn inside all round will give a soft finish to suit the dimpled face of dolly. Make your stitches very close together so that they will not show.

A round piece of cardboard, about the size of a fifty-cent piece, should be covered with the material and adorned with lace or feather-stitching to cover up the gathered circle at the back.



4. The finished bonnet

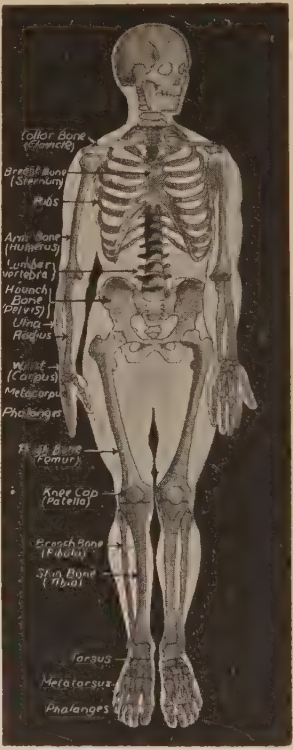
The two little bunches of ribbon which are fastened to the top of the hat are not quite so easy to make as they at first appear. Like everything else, there is a right way and a wrong way to make a ribbon bow, and the right way to make this one is to tie a little loop with strong thread (a long thread being required), bringing another loop by the side of the first one, then a third and a fourth, always twisting the same thread round and round the ribbon without using a needle, until the rosette is quite formed, and is big enough to be put on the bonnet, where it should be secured with a couple of strong stitches. Good milliners boast of the fact that a needle never passes through their ribbons, and their bows are as fresh as if they had just come off the bolt and no hand had touched them.

Some milliners first make and trim their hats in muslin, which can be cut, sewn, done and undone until the shape is perfect, and that is the way in which you must first try to make this little bonnet. Try in muslin or crêpe paper, which is soft and elastic, and lends itself as admirably to this sort of work as to flowers.

THE BONES AND ARTERIES OF OUR BODY
A SECOND LESSON IN FIRST AID TO THE INJURED

CONTINUED FROM PAGE 3964.

IF we are going to be successful in rendering first aid to the injured, it is essential that we should know something about the human body, particularly about the positions of the various bones and arteries. In fact, without a pretty accurate knowledge of where the various arteries are, it would be almost impossible for us to stop a person from bleeding to death who was really seriously injured by having a large artery cut. But when we have once learnt where the arteries are to be found, we know exactly where we should apply the pressure that will stop the bleeding.



THE BONES OF OUR BODY
Here we see their exact positions in relation to the body.

First of all it is important that we should know how the skeleton is made up, and the picture on this page will help us a great deal. We can find the various bones in this picture, and then feel where most of the bones are in our own body. The skeleton is really the framework upon which our body is built up, and in it there are more than two hundred bones, each of which has its proper name. The bones form the supports and the levers of the body. We ought to learn the names of the more important of the bones.

The head, including the face, is formed of twenty-two bones, all joined together and fixed, with the exception of the lower jaw. The head is made up of a front bone, called the frontal, a back bone, called the occipital, which means simply "back of the head," two bones forming the crown, two forming the sides, and two more the base, or floor, of the skull. Then in the face there are fourteen separate bones, including the jaws, but we need not mention these in detail.

The second great division of the body is the trunk, and of this there are two parts—the chest, or thorax, and the lower part, or abdomen. Running right down the whole length of the body from the skull to the extreme end of the back, through the thorax and abdomen, is a long column of small bones joined together by cartilage, which is elastic enough to allow the body to turn from side to side, and bend forward or backward. This column has twenty-four bones altogether, and its proper name is the vertebral column, or vertebræ. These names come from a Latin word, which means to turn. The vertebral column is also called the spine, or back-bone; but, of course, it is not really one bone but twenty-four. The bones are hollow rings, and right down the middle of the column runs the spinal cord, which is really a continuation of the brain. Some of our nerves run from the brain and some from the spinal cord.

The chest, or thorax, is like a cage, with part of the spine forming the back, the breastbone, or sternum, which means breast, forming the front, and twelve pairs of curved bones, known as the ribs, forming the sides. Inside this cage are some of our most important organs—the heart and the lungs. The part of the skeleton in the abdomen is known as the pelvis, which is a Latin word meaning basin. It consists of several bones, the best known of which is a large irregular bone that comes from the back right round to the front, and the upper part of which is generally known as the hip-bone. In children this large bone is in three parts, with cartilage between to allow for growing, but in grown-up people it is all one hard bone. On each side of this bone is a socket, into which the ball-like head of the leg-bone fits, and is able to turn about when we walk, jump, dance, bend, and so on.

The other bones of the skeleton are known as the extremities, the upper extremities being the arms and the lower the legs. The arms are joined to the trunk on each side by a shoulder-blade, or scapula, and by a collar-bone, or clavicle, which means a key, and the bone is so called because it is supposed to be shaped like a key. The collar-bone can be felt on either side of the neck like a rod. Its outer end joins the shoulder-blade. The upper bone of the arm is called the humerus, which is the Latin word for shoulder, and this reaches from the shoulder to the elbow. It is jointed to the two bones of the forearm—the radius, or outer bone, and the ulna, or inner bone. Ulna is another Latin word, the translation of which is elbow.

The bones of the hand are made up of those of the wrist, the palm, and the fingers. There are eight little bones, arranged in two rows of four, forming the wrist, or carpus, then there are five bones called metacarpus, which means "between wrist," because they come between the wrist and the fingers. They form the knuckles. The finger-bones are aptly termed phalanges, and there are three in each of the fingers and two in the thumb. The word phalanges is really the plural of the Greek phalanx, which means battle-line, and the name was probably given because all these little finger-bones when arranged and working in proper order suggested a well-disciplined army.

The bones of the leg correspond with the bones of the arm. There is the large upper, or thigh, bone, called the femur, which means thigh. This is jointed to the two lower bones, the large tibia, or shin-bone, outside and the thinner fibula inside. The leg has what the arm has not—a little plate of bone laid over the joint of the upper and lower bones. This is the kneecap, or patella.

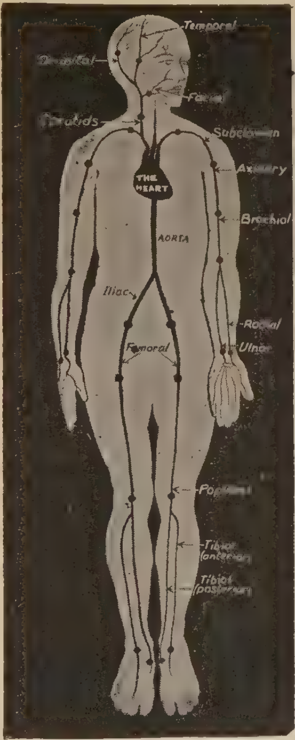
The bones of the foot are very much like those of the hand, and, indeed, the French call the toes the fingers of the feet. In place of the wrist there is the tarsus, or ankle; in place of the metacarpus there is the metatarsus; and then there are the phalanges, or toe-bones, two in the great toe and three in each of the others.

We now come to the arteries. The organs that are engaged in that most important work of circulating the blood through our bodies are the heart, the arteries, the capillaries, and the veins. The heart is like a large pump, that pumps the pure blood into the arteries; these, again, are lesser pumps, that pump it into small vessels called capillaries. The word capillaries is from the Latin word for hairs, and the name is given because the vessels are so very fine that they are like hairs. The blood, having now become impure, passes into the veins, and is carried back to the heart, to the side opposite to that from which it was pumped out. It is then pumped up into the lungs, where, by our breathing, it receives fresh oxygen, and gives up its carbonic acid gas, thus being purified. By the heart and arteries it is then pumped through the body once again, and so the process continues.

It is essential that we know the position of the principal arteries, as arterial bleeding is by far the most serious. We can learn from the picture on this page the positions of these arteries, and it also shows us the places at which pressure has to be applied in order to stop bleeding. It should always be remembered that blood coming from an artery is scarlet, while blood coming from a vein is dark red.

ARTERIES OF HEAD AND NECK. The carotid arteries, right and left, pass up on each side of the windpipe, and then divide into branches, which supply the brain and head. The facial artery crosses the lower jaw, and sends branches to the chin, lips, cheeks, and nose. The temporal artery can be felt in front of the upper part of the ear. The occipital artery is behind the ear, and carries blood to the back of the head.

ARTERIES OF THE UPPER LIMBS. The subclavian artery can be felt pulsating if the finger be passed over the collar-bone at its inner end and pressed downwards and backwards, the shoulder being pressed down with the free hand, so as to bring the artery up nearly to the finger that is feeling for the pulsation. The axillary artery is a continuation of the subclavian, and can be felt if the fingers be pressed into the armpit while the arm is raised well away from the side. The brachial artery is an extension of the axillary artery, and runs down the inner side of the biceps muscle to the front of the joint in the hollow of the elbow. Its course may be roughly seen by looking at the inner seam of the coat. The brachial artery divides at the elbow into the radial and ulnar arteries, which course down the bones after which they are named to the wrist. At the wrist we can always feel the beating of our pulse, which is the blood passing through the radial artery. From the wrist it branches out into the hand and fingers. It forms a curve in the hand, called the palmar arch.



THE ARTERIES OF OUR BODY

The spots show where, in case of injury, we press to stop bleeding.

THE ARTERIES OF THE TRUNK. The aorta, which is the largest of all the arteries, is in the thorax. It arches up from the heart and then descends into the abdomen, where it divides, to the right and to the left, into what are called the iliac arteries.

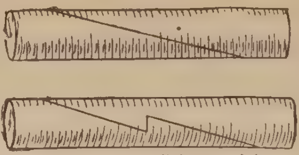
ARTERIES OF THE LOWER LIMBS. The femoral artery is a continuation of the iliac. It enters the thigh in the middle of the groin, where its throbbing may easily be felt, and passes in a winding line to the back of the knee, where it is called the popliteal artery. There it divides into two branches. One passes down the back of the leg as the posterior tibial artery to the inner side of the ankle, entering the sole of the foot as the plantar arteries. The other branch—the anterior tibial artery—passes forward between the tibia and fibula, and runs to the instep and the space between the great and fourth toes. At the instep it is called the dorsal artery of the foot. Passing over the tarsus to the sole, it forms, with the plantar arteries, the plantar arch.

In learning the positions of the bones and the arteries we should practise placing our hands upon the right positions in our own bodies.

THE NEXT LESSONS IN FIRST AID ARE ON PAGE 4288.

TWO WAYS OF SPLICING A STICK

EVERY boy, especially a Boy Scout, ought to know how to splice a stick or a pole, and as the method to be followed is quite simple, there is no reason why anyone need be unable to do this very useful work. The Camp Fire Girl also is interested in the best method of splicing a stick. By proper splicing, poles may be lengthened, broken sticks mended, and other pieces of wood extended to any length that may be required.


Two ways of splicing a stick

The simplest method, which, however, does not give the best and strongest result, is to make a straight splice, as shown in the top picture. The two ends to be joined are cut to a sharp angle, and made to fit exactly upon one another. Then, if we are handling a pole or a beam, the two portions are bolted together, while if it is a stick or a thin pole, instead of bolting the pieces, we glue or screw them to one another. The best method of splicing, however, and by far the strongest, is that known as the bracing-splice. It is rather more difficult than the straight splice, but the extra trouble is well worth while, especially if there is to be much strain upon the jointed pole or stick. Instead of there being a straight, slanting cut at the end of each portion, a kind of step is cut in each piece, and the two portions then fit each other exactly, as shown in the bottom picture. They may be fastened together by having wire bound round, if the pole is a thick one, or by using glue if we are splicing a stick. If we are splicing a new piece of wood to some article, and the new wood needs shaping to match the old, the splicing should always be done first, and then the new portion can be worked to whatever shape may be required.

THE PUZZLE OF THE TREES IN THE PARK

A GENTLEMAN who had a fine park found one day that a storm during the previous night had blown down a number of his trees, and so he telegraphed to a nurseryman to send down twenty-four young trees that might be planted in place of those which had been destroyed.

When the trees came, the owner of the park told his gardener that he wanted the twenty-four trees planted in such a way that there would be twenty-eight rows, each containing four trees in a straight line. The gardener thought the gentleman had made a mistake in the number of rows, so he asked him again how the trees were to be planted. The gentleman repeated that he wanted twenty-eight rows of four trees each, and the gardener insisted that this was impossible with twenty-four trees.

"Come into my study," said the gentleman, "and I will draw a plan for you, and you will see exactly how I want the trees to stand. It is quite easy to get twenty-eight rows with only four trees in each row."

The gardener followed the gentleman to the study, and in a moment or two the gentleman had drawn his plan, when the gardener owned that the task which at first had seemed quite impossible to him was very plain and simple. How were the trees planted? The gentleman's plan showing the twenty-eight rows is given on page 4295.

THE PROBLEM OF THE TRAVELER'S DINNER

A LONG time ago two Arabs, who were traveling to Baghdad, stopped at a small village for their mid-day meal. One of them had five loaves of bread with him and the other only three. Just as they were about to begin eating, a stranger came up, and, saying that he had money but no food, asked if he might share their meal. He promised to pay for what he had, and so the two travelers agreed to divide the loaves equally among the three, and invited him to sit down.

After the meal was over and all the food had been eaten, the stranger laid down eight coins of equal value in payment for the food he had eaten, and, bidding his hosts good-bye, went away. The traveler who had five loaves took up five of the coins as his share, and left three for the man who had had three loaves. But this man disputed the division of the money, and insisted that he should receive half of it.

The men began to quarrel very bitterly, and as they could not agree they went before the magistrate, so that he could decide who was right. The magistrate listened attentively to the story which the men had to tell, and then, to the astonishment of both, and of the people standing by, he said: "Let the man who had five loaves take seven of the coins and the man who had three take only one; that will be a fair division of the money." Was his decision just? The explanation which he gave will be found on page 4295.

THE NEXT THINGS TO MAKE AND THINGS TO DO BEGIN ON PAGE 4287.

GAMES TO PLAY IN THE HAY-FIELD

There are all sorts of games that can be played in the hay, and this picture shows us a new way of playing hide-and-seek. Some boys and girls bury themselves in a pile of hay, and then their companions have to identify them by the feet that remain sticking out.

It is much more difficult than we should think to guess the boys or girls by their feet. The little girl seen standing, in this picture and the last, has given wrong guesses in nearly every case. She is very much surprised when the signal is given to sit up and show faces.

Three-legged races in the hay cause much fun and amusement. Here we see two pairs of partners their legs tied together with handkerchiefs, ready for the signal to start. A good winning-post is a rake held up by the umpire, as seen in the next picture.

The race is here shown in progress. There is no set rule as to how the players are to get to the winning-post, and we can see that while some are walking or running, others think that they can cover the ground more quickly by crawling along in the hay.

Another good form of race for the hay-field is a hopping race. The players stand in a row, and when the signal is given they start off, and must hop all the way on one foot. If they put their second foot to the ground more than three times they are disqualified.

No hay-party is complete without a toy wagon to load up, and a vehicle like that shown in the picture can be easily made out of a long wooden box put on four wheels taken from an old barrow or baby-carriage. We can then take turns to ride upon the load of hay.

THE OX-EYE DAISY

This is one of the most showy members of the daisy family, the flowers being something like those of the May-weed, but much larger. The ox-eye daisy is a favorite with children, who string the flower-heads together. It is a member of the chrysanthemum family.

THE YELLOW TOAD-FLAX

The flower of the toad-flax is in shape much like the snapdragon of our gardens, but, unlike that plant, it has a long spur projecting from its base. The deep yellow flowers are responsible for the name of butter-and-eggs often given to the toad-flax.

THE WILD CARROT

It is from this plant that the fine carrots of our tables have been developed. When the fruit succeeds the white blossoms, the flower-heads become shaped like curious hollow cups, and are called bird's nests.

THE COMMON RAGWORT

This flower seems to grow everywhere, and blooms in the late summer and the autumn. Its golden stars produce many seeds, and the plant spreads very rapidly. It is a close relative of the groundsel.

ROADSIDE PLANTS AND WEEDS

CONTINUED FROM 4136.

BY HELEN INGERSOL

IF dirt is matter out of place then weeds may be considered to be plants out of their proper places. There are many herbs that grow in an unobtrusive manner in their native country, but when transplanted to foreign shores overrun the waysides and fields, and choke out the flowers that belong there. The same thing, as we may read in the stories elsewhere in the book, is true of insects and birds and small animals, like the rabbit. Some weeds seem to be troublesome to farmers wherever they may be, sturdy plants capable of surviving all kinds of ill-treatment and ready to seize any chance of bettering themselves.

Our roadside weeds, and the pests of the cultivated fields, have often come to us from abroad. They travel here in various ways; plants, brought over as keepsakes from old gardens, have sent their seeds broadcast, or have spread by runners; seeds have been brought in with imported seed-grains and have spilled from vehicles, or been unknowingly sown; burrs and other fruits have clung to wool and hides; and in a hundred secret ways, the weeds have crept in and humbly or arrogantly fought for a living. Once here birds and beasts distribute them. Most of the weeds are so common that a mere glance at the pictures will discover some that we know. We shall soon notice, moreover, that many of them belong to the family of bell flowers, which includes the chicory tribe, the ragweeds, and the huge group of composites.

Perhaps this may be explained by the fact that the last three families have fruits, called achenes, that are small and dry, and contain each one seed inseparably wrapped in the tube of the flower's calyx. The sepals are deformed and now appear as teeth, or scales, or bristles, hard or soft, or as stiff prickle-like objects called awls. These form what is called a pappus, and it may also take the shape of a little cup or crown. Sometimes it is not present at all. This curious development of the seed-vessels and calyx has gradually been brought about, in most cases, to furnish each fruit a means of traveling. For each little seedling may find much better soil or conditions for growing in some other part of the field, let us say, than in the special corner where its parent grew. A study of weeds, therefore, includes a study of their seeds. Through this study we shall discover the interesting way in which seeds are carried from place to place, and the means that each family has to send its seeds abroad. A study of the seeds also helps the farmer to find them and to destroy them.

Copyright, 1911, 1918, by M. Perry Mills.

THE SILKY PLUMES OF THE DANDELION

We have all taken a puff or two at the soft globes of a ripe dandelion head to see what o'clock it is. In a little cloud the down flies away, leaving only one or two plumes sticking to the disk on top of the stem. Let us forbear to blow these away and look at them closely instead. We shall promptly see a little spindle-shaped achene topped with a slender stem bearing a tuft of downy bristles. Pouf! Away it goes, lighter than air, the tuft of down carrying the achene swinging beneath it far afield, springing in the eddies of the breeze until it strikes a tall bush, or the wind drops and the parachute falls to the earth, and the pointed end sticks in. It has barbs, which prevent its blowing out again, and the parachute, having served its purpose, soon perishes. If in suitable soil (and nearly every soil is suitable for a dandelion), dust blows over it, or it sinks into a tiny crevice in the ground, and the early rains start it into growth.

It will continue to grow all summer, gradually choking out the grass in its vicinity by covering it with the deeply-jagged leaves, which it arranges in a flat tuft of circular outline, like many other pasture plants. In this way it may escape being clipped by the teeth of browsing cattle. The dandelion does not hug the ground so closely as other weeds, but it is provided with a milky juice so bitter that no animal wants to taste it more than once. Oddly enough this very bitterness recommends the plants to *us* as a spring salad.

By fall the dandelion has grown large and strong, and has stored much starchy nutriment in its firmly-fastened root. Even its flower-heads are pretty well developed, ready to bloom into golden buttons during a warm spell. But then it is in danger again, for the root yields a drug, and is therefore dug up.

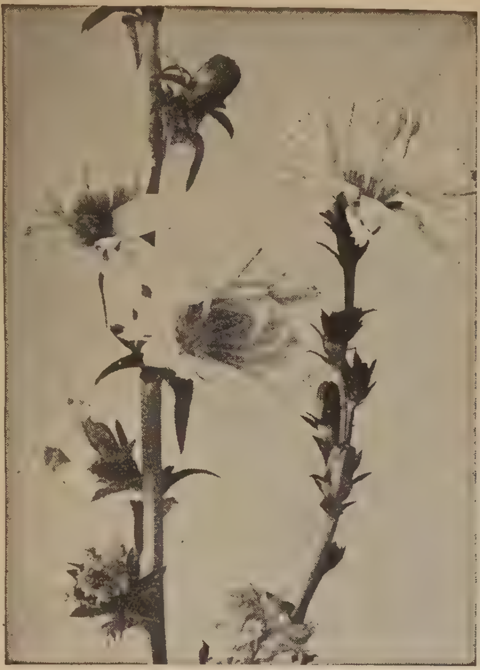
THE CHICORY CLOSES ITS FLOWERS AT NIGHTFALL OR BEFORE RAIN

Very closely allied to the dandelion is the chicory, bearing flowers azure blue when newly opened, but often fading to pink, and sometimes occurring in a white variety. Apart from its jagged root-leaves, the chicory is very different from the dandelion in appearance. It is tall and ungainly, the branches striking out at various angles. The foliage is gray-green and scanty, and generally dusty, for the chicory haunts roadsides and waste lands. Clustered in groups on the bare stems, at awkward intervals, are the flat heads nearly two inches across, setting close to the branches. They open wide when the sun shines, but towards sundown, or if rain seems likely to fall, close by raising the rays until these stand in a close group over the centre of the flower. This is in order to protect the precious pollen, that is placed in a perilous position by heavy dampness. Each floweret, tubular at the base, is prolonged on one side into a long, strap-like ray, which sticks out not unlike a tongue, and is called a ligule. Each ligule extends over a flower in an outer row and shelters it. A ring of five anthers with stamens united stands in the tube of the floweret, and very quickly pollen is discharged through the inner slits of these anthers, filling up the tube, over the young pistil. The style of this pistil, however, when the pollen is freed, begins to grow, and as it grows it pushes the pollen up until it is piled about the opening of the tube, where rain would soon destroy it. During the closing process that we have described, the flowerets are of course brought closely together and become fertilized by actual contact, which is made very sure by having the inner rays shorter than those of the outer circles, so that the "tongues" do not get in the way. Moreover, the stigmas of the outer rings mature before those of the inner. This is because when the floweret commences to fade, as happens just at the outer edge of the head, the branches of the style, that have been shut close together while the pistil pushed through the tube, begin to spread over and curve downwards, and so expose the inner stigmatic surface, hitherto concealed, ready to pick up the pollen.

With slight differences, this description of the method of fertilization will answer as well for the dandelion, as for the chicory, the mouse-eared hawkweed and the sow-thistle, that we shall next consider.

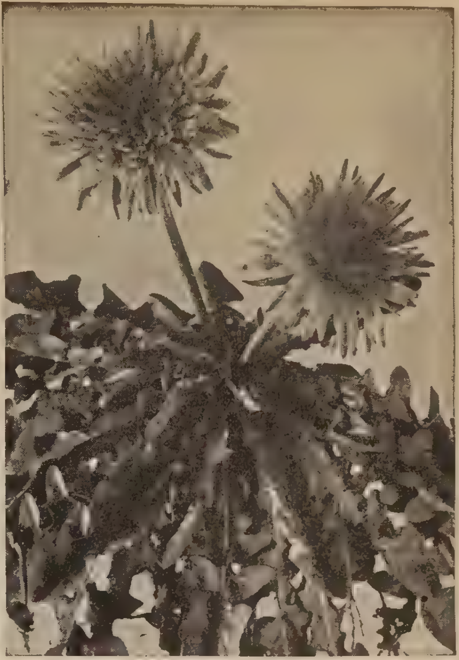
THE YELLOW MOUSE-EARED HAWKWEED

The pale yellow flower-heads of the mouse-eared hawkweed, poised solitary on slender stalks, are not unlike those of the dandelion, but the soft, oblong, or spatulate leaves, felted beneath with star-shaped hairs, are very different. It has drifted over here from Europe, and is a



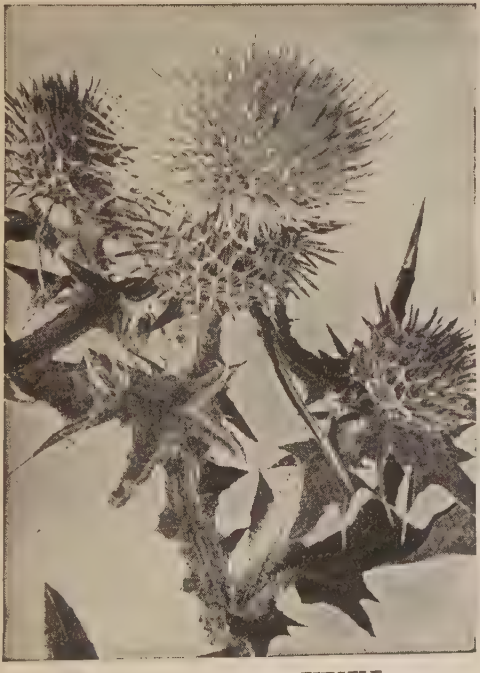
THE WILD CHICORY

The chicory is an attractive flower, something like a dandelion in size and shape, but lilac-blue in color instead of yellow. The root is roasted to use with coffee.



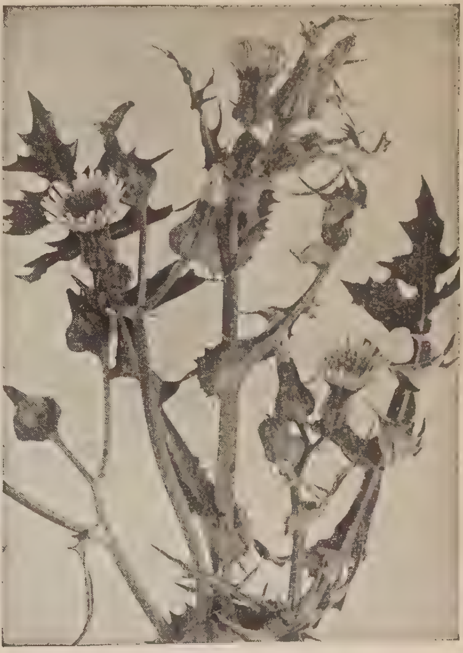
THE COMMON DANDELION

This is the real dandelion, although the name is given to other plants. What we call the flower is really a bunch of flowers. The dandelion is used as medicine.



THE SPEAR PLUME THISTLE

Despite the contempt that attaches to the name of thistle, we must all agree that the spear plume thistle, when it grows several feet high, and is crowned with purple flower-heads, is really an ornament to the field. It is commonly found in a fence-corner or beside a rock.



THE COMMON SOW-THISTLE

The name sow-thistle has nothing whatever to do with the sow, but is from a Greek word meaning hollow, referring to the stems. The plant is a favorite food for rabbits. It is also called the milk-thistle, because of the milky juice inside the stem.

prostrate, mat-like herb, that sends long stems running over the ground, taking root at short intervals. It is a bad pest in parts of North America, like certain other allied species.

THE ORANGE HAWKWEED THAT RUINS FINE PASTURES

The orange hawkweed, or devil's paint-brush, that sends up a corymb of flame-colored flower-heads, is very striking but also has runners and small seeds that, borne by a tuft of dusky white bristles, whisk into rich pastures, and land that cannot be ploughed, soon smothering the grasses with their useless but abundant foliage. Oddly enough, it is a very near relative of several of our own woodland plants, the rattlesnake-weeds, that meekly stay in the copses, and do not overrun the fields as the imported species do.

THE COMMON SOW-THISTLE, ONE OF OUR TALLEST WEEDS

A striking weed, shooting up to a man's height, is the common sow-thistle or hare's-lettuce, topped with small, pale dandelion-like flowers, exuding a milky, sticky juice wherever bruised, and with a spire-like effect caused by the graduation in size of the foliage from the large leaves of the base to narrow clasping ones at the top. It is fortunately an annual, haunting gardens and stubble-fields. Towards the end of summer, the tall plant is fairly veiled in the whitish heads of the fruit, each with a tuft of soft pappus-bristles. They cling to one's clothes and to weeds, and blow away in groups.

THE BRANCHING GROUNDSEL WITH RAYLESS FLOWERS

The little branching groundsel has small tassels of greenish flowers that look as if the rays had all fallen away. As a matter of fact, however, they never had any, but the plant nevertheless manages to perfect its seeds, with their little tufts, and send them far afield, landing by preference in gardens.

A BRILLIANT WEED SAID TO BE POISONOUS TO CATTLE

A very close relative to the groundsel, the ragwort, is a thick-rooted perennial, short-lived, fortunately, for it is declared to cause an odd but fatal disease of the liver in cattle when eaten by them. The old name staggerwort may refer to this. It is a tall, coarse plant bearing deeply twice-pinnatified leaves, the segments waving over and under each other, very close-set and dark-green in hue. Heavy, showy corymbs of golden-yellow flat flowers, with toothed rays, terminate the stalks. The seeds have a soft white pappus.

THE SPEAR-THISTLES ARE ROBBED BY THE GOLDFINCHES

Although we may have idly noticed that the spear-thistle is apt to be growing in a fence-corner, or beside a rock, we have probably never even wondered why. It is a striking plant with stems armed with spiny ridges, the mid-veins of the leaves running down them, and with equally prickly foliage ending in a long spear-like point. The purple flower-heads are large and handsome. Although composites, the thistle-heads have no rays. They are simply tufts of slender tubular florets, that are soon displaced by the achenes and the soft white thistle-down, which are both so attractive to the lovely little goldfinches, who eat the one, unalarmed by the spines, and line their nests with the other. Each large achene, when the scales open slightly, and allow it to escape, floats away supported by its parachute of plumy bristles. There are two other very common weeds which have no pappus whatever.

THE OX-EYE DAISY THAT TELLS A CHILD'S FORTUNE

We have all seen the sheets of white bloom that cover badly-tilled or neglected pastures, where the ox-eye daisy is in flower. White-weed the farmer calls the tall strong-smelling plant that chokes out the grass in his hay meadows, and is despised by cattle. Yet it is a member of our cherished chrysanthemum tribe and is surely very handsome with its pure-white petals, that children pick off, one by one, to see just whom they are to marry—"Poor man, rich man, beggar-man, thief."

The yarrow, that pretty roadside plant with very finely divided, fern-like leaves, is not a very noxious weed, although it is likely to give a bitter taste and strong odor to milk. It also furnishes a stimulant drug. The flower-heads, in flat-topped clusters, have greenish-white disk flowers, rather an unusual color, and white rays, and the achenes are flat and oblong.

THE BURDOCK

Another composite, which we have not always realized, perhaps, to be the cousin of the thistle and groundsel, has gone a

THE MOUSE-EARED HAWK-WEED

This plant is sometimes mistaken for the dandelion by those who are not botanists, its yellow flower-heads being something like the dandelion's flowers.

THE COMMON GROUNDSEL

This belongs to the daisy family, and is one of the most widely found plants in temperate regions, owing to the fluffy seeds being carried everywhere by the wind.

THE COMMON BURDOCK

This plant, with its balls of green bristles surrounding the flowers, is known to all boys, because each bristle has a hook, and when the bristly heads are thrown at anyone they at once cling fast to his clothes.

THE COMMON YARROW, OR MILFOIL

The yarrow is one of our commonest wild plants, and its flowers, that grow in dense clusters at the ends of the stems, vary from white to pink. The name is a corruption of ye arrow, a reference to the shape of the leaves.

step further in the utilization of its protective bracts, forming the involucre about the base of its globular heads of purple, tube-shaped flowers. The involucre itself is almost ball-shaped, the flowerets protruding from the top; and the closely over-lapping bracts are stiff and shaped like a lance prolonged into long spines that are spreading or are hooked at the tip. This is the burdock, a plant of dock-like appearance, and with fruits like burrs. One can easily imagine, from one's struggles with the fruits that have become entangled in the clothing, how far the "burrs" would be carried when firmly fastened in the woolly coat of a sheep, or the long hairs of a cow's or dog's coat. The burdock therefore becomes a common roadside and waste-land weed. It has its uses, however; the long tapering root furnishing a medicine for blood and skin diseases, while the great, fresh leaves form a cooling poultice for ulcers.

THE WILD CARROT, OR QUEEN ANNE'S LACE

At last we may leave the composite family, and proceed to the umbel-bearers, in which we shall find one conspicuous plant, the wild carrot, which we should doubtless admire very much if it were not so common. Queen Anne's Lace, the English children call the large disks of tiny white flowerets, poised on slender stems. The outer ones have their petals enlarged on the outer side to make the umbel more showy. And always in the centre of the whorls is a maroon-colored floweret,—why, no one can tell. The finely cut leaves are as graceful as fern-fronds. This is the plant from which our garden carrot has been developed by the gardener's patience. At night, the umbel nods, to protect its flowerets, and when time ripens the seeds, the ribs curve inwards, and the flower-head becomes a ball,—a small tumble-weed that breaks off from the stem and is whirled over the snow to pile up in a corner and shed its seeds with those of other refugees.

HOW THE BEE FERTILIZES THE BUTTER-AND-EGGS

Growing with, or under, the wild carrot is the butter-and-eggs. In England, however, people will persist in regarding it as the snapdragon. It is the common toad-flax, so called because its leaves are long and narrow, like those of the flax, and the closed lips of the flower are thought to resemble the muzzle of a toad. It is a bright, clear yellow, and the lips are marked with deeper yellow or orange to show the bee where it opens to admit her in her search for honey. Her weight, as she alights upon a pair of knobs bulging from the lip, forces it down; and as she pushes into the flower she rubs under two pairs of large stamens arching under the upper lip, and drags out of them round balls of pollen.

Smaller insects cannot press this flower open. The flowers are crowded at the upper part of the stems, thus adding to their showiness, but, even before the plant comes into flower, its numerous narrow leaves, of a whitish-green color, make it look very pretty. Sometimes the five topmost buds of the raceme unite in order to form a monstrous flower of regular form with five spurs.

THE BUTTERCUPS THAT LITTLE CHILDREN LOVE

We can scarcely cross a meadow at any time of the year without finding a few buttercups, but it is in spring and early summer that we find them well in flower. There is a general idea that the name of these plants is due to the shape of the flower; but the old English spelling was *buttercop*, and cop meant a stud or button.

Now there are many kinds of buttercup in the crowfoot family, and it is very interesting to search for them and note the differences between them. One of the earliest to flower is the meadow buttercup. It is an erect plant with large stalked leaves, nearly round or five-sided in general outline, but divided into five or more parts, and each part is cut into several broad teeth. The leaves on the branched, flowering stem are simpler in form, less divided, and without stalks. The flowers on one plant are very numerous, and both sepals and petals spread wide and flat so that the flower is more saucer-shaped than cup-shaped. It is common and has been introduced from Europe. There is one odd thing about the tribe of buttercups,—the honey is secreted in a tiny depression at the base of each golden petal and is there protected by a little scale.

THE SHEPHERD'S PURSE HAS THOUSANDS OF TINY SEEDS

In the mustard family we find two weeds so unlike that we should find it hard to believe in their close relationship

THE MEADOW BUTTERCUP
There are many kinds of buttercups, and this one is found in meadows. The flowers are called bachelor's buttons. The French name means golden buttons.

THE YELLOW MELILOT
This plant belongs to the pea family, and is dainty and graceful with its pale yellow flowers. When drying, it smells like new hay, and was once used for fodder.

THE WILD MUSTARD
The wild mustard, or charlock, is a pretty sight for the tourist, but it is a great nuisance to the farmer. It covers his fields with a waving sheet of yellow blossoms that have to be up-rooted by hand. The plant is covered with rough bristles.

THE SHEPHERD'S PURSE
This is a very common weed, and is to be found almost everywhere that man has gone. It is called shepherd's purse because the seed-vessel is like a little pouch, and shepherds used it as a charm, believing that it saved their sheep from wolves.

were it not for the four petals in the shape of a Maltese cross.

One of them, the shepherd's purse, with a rosette of narrow deeply-lobed leaves and tiny white flowers, differs greatly from the much larger charlocks in the shape of its seed-pods. These are flat and heart-shaped, and split down the middle to set the seeds free. Old-fashioned purses were shaped like this, and opened in a similar way, so we can easily guess how the plant got its name. These purses stand erect on their little foot-stalks. Its winter rosettes crowd out grass and clover, and a single plant will ripen 50,000 seeds, so in spite of its small size it is to be dreaded in meadows as well as gardens.

THE CHARLOCK'S GOLDEN FLOWERS HATED BY THE FARMER

In May, and less abundantly in later months, we shall find ill-tended lands all golden with the bright yellow flowers of the charlock, an annual of the cross-bearing family that is cordially disliked by the farmer. It is covered with rough bristles, and its leaves have their edges cut into bold teeth of several sizes. It has long, slender seed-pods containing a single row of dark brown seeds. In some places it is known as wild mustard.

THE BINDWEED A RELATIVE OF THE MORNING-GLORY

The pretty bindweed is a pest that is very hard to kill, since it persists in an unbelievable manner owing to the vitality of its fleshy rootstocks. It trails along the ground or winds up the grain-stalks. Its large, brown seeds, like those of the cultivated morning-glory, in whose family it belongs, should be taken out of grain before it is sowed.

CHICKWEED AND CORNCOCKLE, TWO PERSISTENT WEEDS

In the pink family we have two very unlike plants. One is the humble and persistent chickweed, whose tiny white flowers open during practically the whole year. The other is the tall corncockle, with decoratively designed, pale-magenta blossoms, with characteristic radiating lines on their heart-shaped petals and long pointed calyx-lobes that form a green star beneath the flower. It has slender-jointed, hard, round stems with narrow lance-shaped leaves in pairs; the whole plant is covered with white, woolly hairs, even to the long points of the calyx.

Although the petals spread out so broadly that the flower may be as much as two inches across, we can see by pulling them out that they grow very slender at the base, and are called "claws." The flowers are self-fertilized, after allowing insects to visit them, by the elongation of the stamens until they come in contact with the several stigmas. The resulting fruit is a swollen capsule filled with little black seeds, somewhat triangular in shape and bearing rows of teeth. These capsules are often discovered in grain, and should be cast out, for they not only discolor the flour, but render it unwholesome, being poisonous. Cheap, poor flour containing cockle-seeds, when fed to poultry or other animals, causes either a quick death or one resulting later from a chronic disease.

THE BLACK NIGHTSHADE IS A DANGEROUS WEED

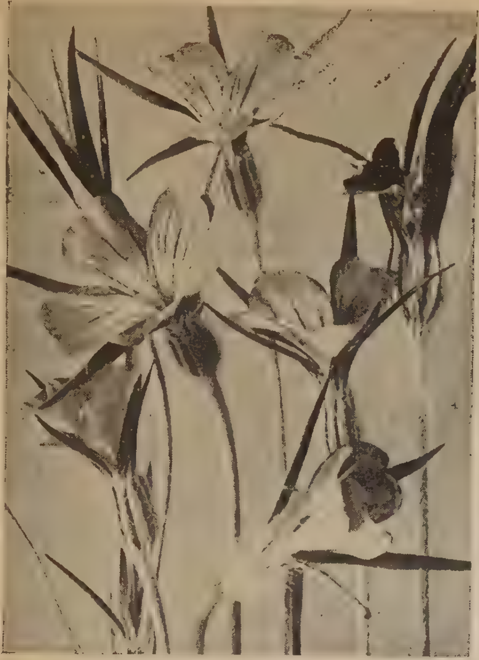
Among our poisonous plants we must not forget the black nightshade, another member of that dangerous potato family. It is a weak little herb, delighting in damp shady places, with wavy-edged ovate leaves, drooping clusters of small white flowers like those of the potato, and tempting, juicy, round, black berries. It is poisonous in every part, even small browsing animals being affected, and is therefore a very bad thing for youngsters to nibble.

THE BITTER-TASTING TANSY

The bitter-tasting tansy, with its bunches of bright-yellow, flat-topped little flower-heads and beautiful fern-like leaves, often stands by the roadside; and in dry fields we will find shooting up the long spears of tall mulleins, with soft, yellow flowers, and plush-like leaves, so hoary and wide, which the English admire so that they cultivate our weed as a garden-plant, known as "velvet-leaf."

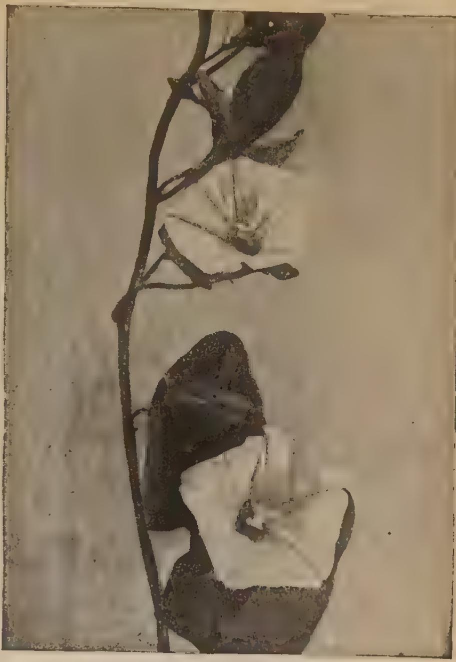
We have spoken of the rolled up fruiting heads of wild carrots, carrying seeds afield. There are certain other weeds, that, in the fall, also dry up, and either breaking away from their central tap-roots, or pulling them out of the dry soil, roll themselves into balls and are blown hither and yon across the open plains. Such are the dreaded Russian thistles, which are very like the prickly saltwort of our beaches, and a related "tumble-weed" of the prairies. Both belong to the goosefoot family.

THE NEXT NATURE STORY IS ON PAGE 4349.



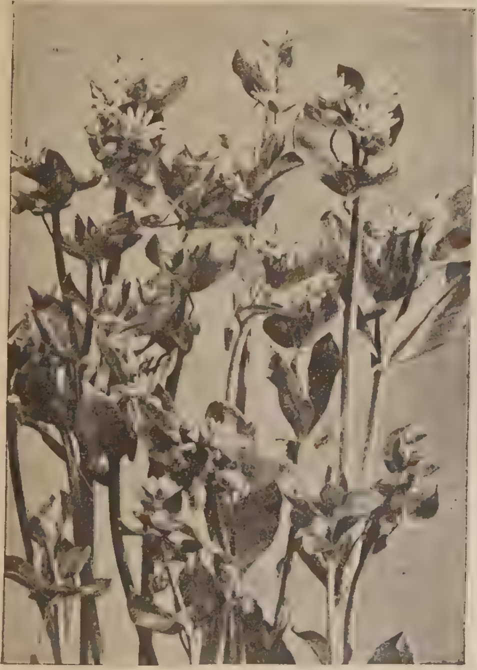
THE CORN-COCKLE

The rich crimson-purple flowers of the corn-cockle, measuring about two inches across, are conspicuous in grainfields from June to September. The plant itself grows four or five feet high, and the stems, on which the flowers grow singly, are covered with hairs.



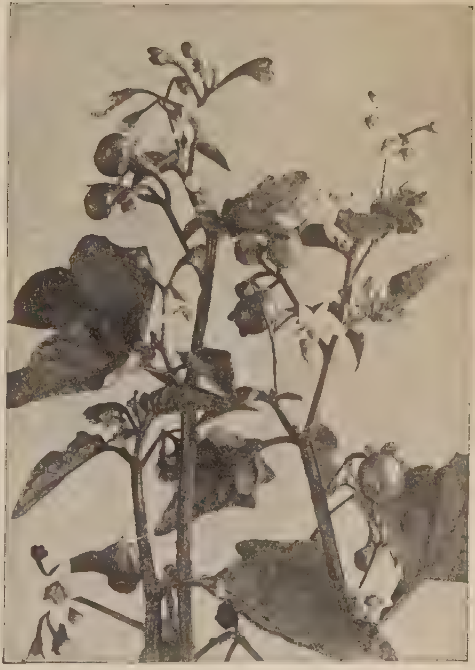
THE FIELD CONVOLVULUS

It seems a pity that the pretty little field convolvulus, or bindweed, that is so common in our grainfields and other cultivated ground, should be a dangerous pest to farmers and gardeners, strangling almost everything that it twines round as it climbs.



THE COMMON CHICKWEED

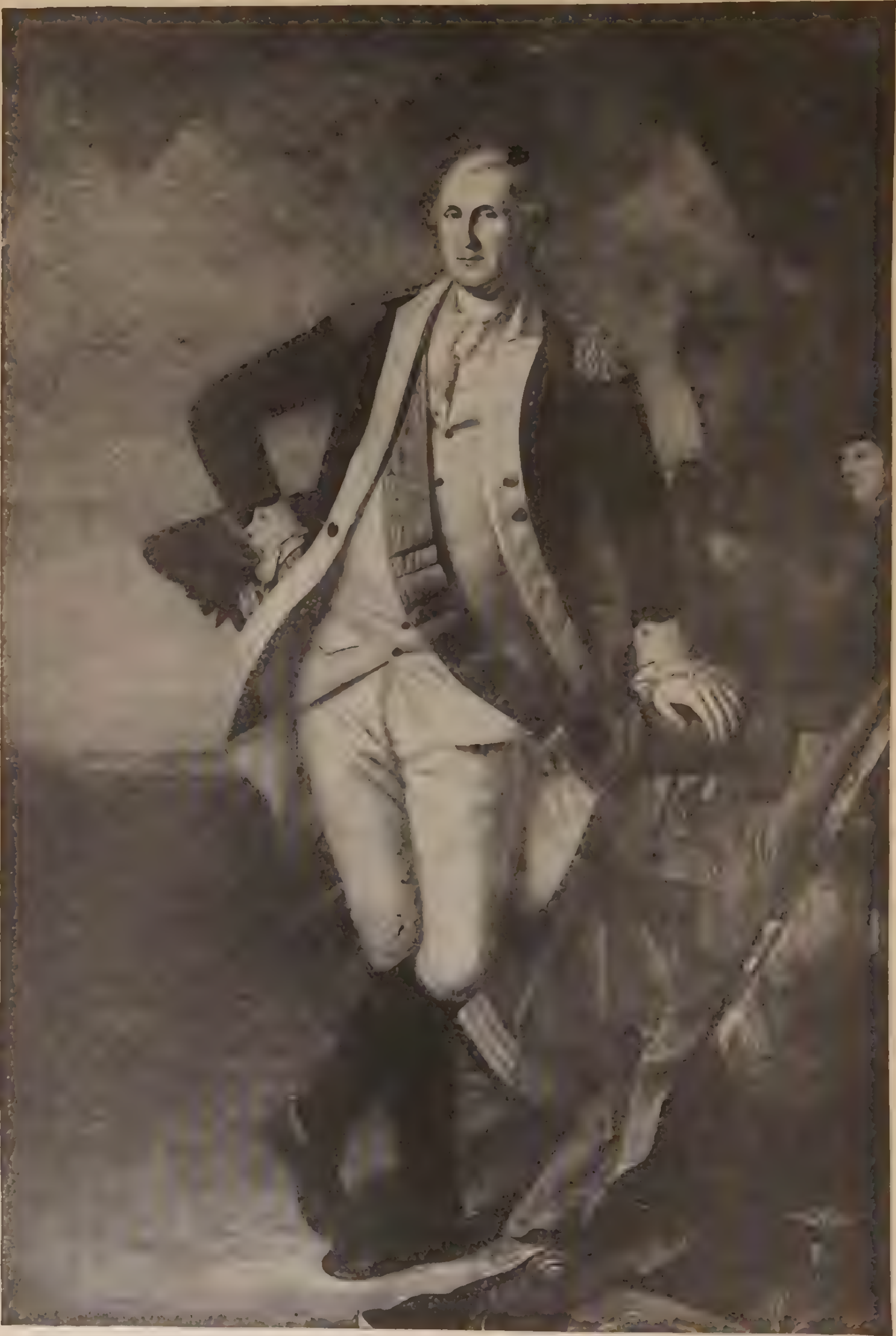
The chickweed flowers from spring to autumn; but it is an untidy plant. It thrives well in a garden, where we do not want it. Canaries like the seeds.



THE BLACK NIGHTSHADE

This is a dangerous plant to meddle with, for the green parts are poisonous and the purple-black berries are very injurious to children. The flowers are white.

WASHINGTON AS A YOUNG MAN



The likeness of Washington we usually see is made from the Stuart portraits. This, by Charles Willson Peale, represents him as a much younger man, before his mouth had been changed by the loss of his teeth. Washington is here shown in the brilliant blue and scarlet uniform of a colonel of Virginia militia.

WHAT THIS STORY TELLS US

THE founders of our country had small leisure and little money for pictures. Besides many of them were stern Puritans, who were inclined to think that pictures were sinful. But after the first hard years had passed, and the settlements became more prosperous, the love of beautiful things which is planted in all our hearts, claimed means of expression, and boys began to attempt to paint pictures. We have not space in this story to tell of all the hardships that the men who made the early history of our art encountered. Many of them were self taught. and had not even good pictures to copy. Some of them had to tramp through the country, painting portraits for a few dollars, to earn their daily bread. But they struggled on, attempting to reproduce the beauty that they saw, and on the foundation that they built, a national school of painting grew up, to which we may point with pride.

PAINTERS OF THE UNITED STATES

CONTINUED FROM 4164

THE people who settled our country had fled away from home, trying to live as they thought best and right. They were far too busy, clearing the wilderness, making new homes and protecting these from wild beasts and wild Indians to think about art. They seldom saw a picture. Indeed the old Puritans were inclined to condemn the beautifying of life by art and music, as wrongful waste of time. But when their early difficulties were over and life easier, they became less severe. A few paintings gradually found their way across the seas, but there was little or no American art until the middle of the eighteenth century. As is always the case, when life became so civilized that it no longer took all a man's energy to provide for the needs of his body, he felt stirred to desire higher interests, art and literature and music.

The first pictures were all portraits. There were, of course, no photographers in those days, and many of the first painters tramped through the country, painting portraits—limning, they called it—for a few dollars each.

A certain Swede—Gustavus Hesselius—is said to have been the first painter in this country.

OUR EARLY PORTRAIT PAINTERS

Our first important American painter was Benjamin West, born of Quaker parents near Philadelphia, in 1738. He had no early training, but fascinated by the colors, the vivid reds, blues and yellows with which the Indians painted their bodies, he taught himself much by experimenting with these. A gentleman interested in the boy's efforts, gave him a paint box, and very soon he was successfully painting portraits. When he was twenty-one another friend sent him to Rome and from then on he won great success. Much of his life was passed in London, where he was knighted, became very popular, and where he succeeded Sir Joshua Reynolds as president of the Royal Academy. He had the kindest feeling for needy art students and helped many a talented young American. He died in London in 1820, and was buried in St. Paul's Cathedral with impressive ceremony.

His work, once so greatly admired, looks somewhat hard and out of drawing to the modern critic. But he deserves to be remembered because his pictures show imagination, something more than merely faithful copying of the sitter's outward aspect, and because he pointed the way to others of greater talent.

John Singleton Copley is one of the most illustrious of our early painters. His parents were Irish, and his father was a tobacconist in Boston when the

Copyright, 1911, 1918, by M. Perry Mills.

artist was born in 1737. Soon after, his father died, and later his mother married Peter Pelham, a painter and engraver, who gave his stepson valuable training. For a time Copley worked at engraving but soon took to portrait-painting. His subjects were the aristocrats of the New World, men and women of character and culture, and he was especially successful in conveying a sense of dignity and personal distinction. One of his best known portraits is that of Lady Wentworth, then a Boston belle of nineteen.

Copley himself, handsome, clever in conversation, of delightful manners, was a great favorite in New England society. When thirty-two he married Miss Clark, the daughter of a wealthy merchant, the very man to whom was consigned the famous cargo of tea flung into Boston Harbor a few years later. Our early artists, however successful, felt the lack of artistic atmosphere. They longed to study the pictures of the Old World. At the height of his success, Copley went to Rome, and later to London, where he was welcomed by West and remained until his death. His son became Lord Chancellor of England.

Philadelphia has the distinction of being our earliest art centre. At the dawn of the Revolution it was our biggest city, as well as the richest and most fashionable. From early days, Philadelphia had been rather more liberal-minded toward the arts than severe New England. Perhaps the most famous of early Philadelphia painters was Charles Wilson Peale. Like many another American artist he began as an artistic craftsman. He became an expert worker in wood, leather and metal. Then the Swedish painter, Hesselius, gave him drawing lessons and he decided to be an artist. He went to Boston to study with Copley, and then to London, where he studied with Benjamin West. He then returned to this country, where his first important work was a life-size portrait of George Washington in the striking blue and scarlet uniform of a Virginia colonel.

Peale himself became a soldier of the Revolution and fought bravely in the battles of Trenton and Germantown. He began his second portrait of Washington,—a commission from Congress,—in 1777, during the dreary waiting at Valley Forge. He painted fourteen portraits of Washington, and the portraits also of many other distinguished men. Peale deserves to be remembered for other services to American art. He organized the first exhibition of paintings ever held in this country and was one of the founders of the Pennsylvania Academy of Art.

Gilbert Stuart, another painter of lasting fame, was one of the first to paint with individuality. The son of a Scotch refugee and a Welshwoman, he was born at Narragansett in 1755 and showed his talent for drawing as a child. He was eighteen when a Scotch artist, visiting in this country, gave him lessons, and invited him to go back to Scotland with him. Young Stuart was placed in the University of Glasgow, but his protector died, and the boy, poor and homesick, was glad to make his way home on a collier. His family were Tories, and at the outbreak of the Revolution, he fled to London. There he was befriended by West, who took him as assistant, for which position, however, he was too independent in ideas and methods. He formed his own theories of painting and was perhaps the first to present his subjects as he saw them with freedom and naturalness, until then unknown. His work marks a great gain in lifelikeness and sincerity.

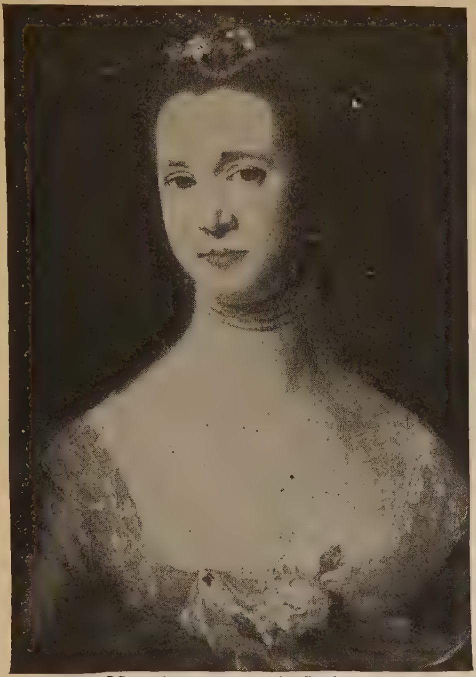
Among his most famous portraits are those of Dr. Fothergill, a distinguished Quaker physician, and the one of George Washington known as the Athenaeum Portrait, now hanging in the Museum of Fine Arts in Boston. Stuart lived in Boston from 1794 until his death in 1828.

PAINTERS OF HISTORICAL PICTURES

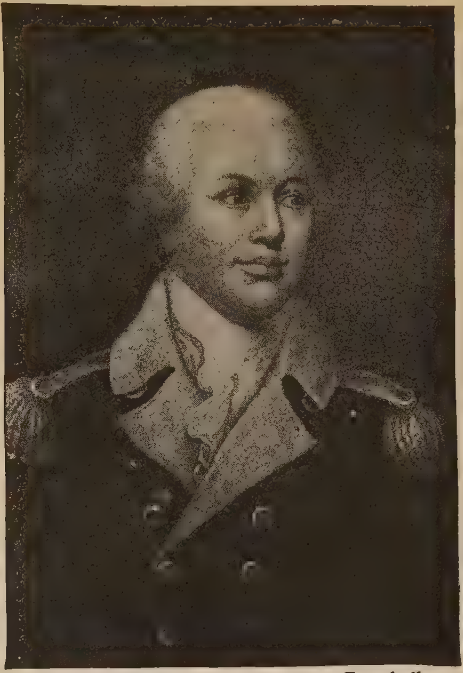
When the great struggle of the Revolution ended, the spirit of partriotism, which had been kindled and strengthened by sufferings endured, found expression in art. Our artists were no longer satisfied to paint only portraits. Henceforth we have pictures representing historic and stirring scenes.

John Trumbull has been called the connecting link between the early portrait painters and the painters of landscape. Born in Lebanon, Conn., the son of a colonial governor, and graduated at Harvard, he fell under the best educative influence of his day. As a mere boy he joined the Revolutionary army and was soon making himself useful to Washington by his skilful drawing of the

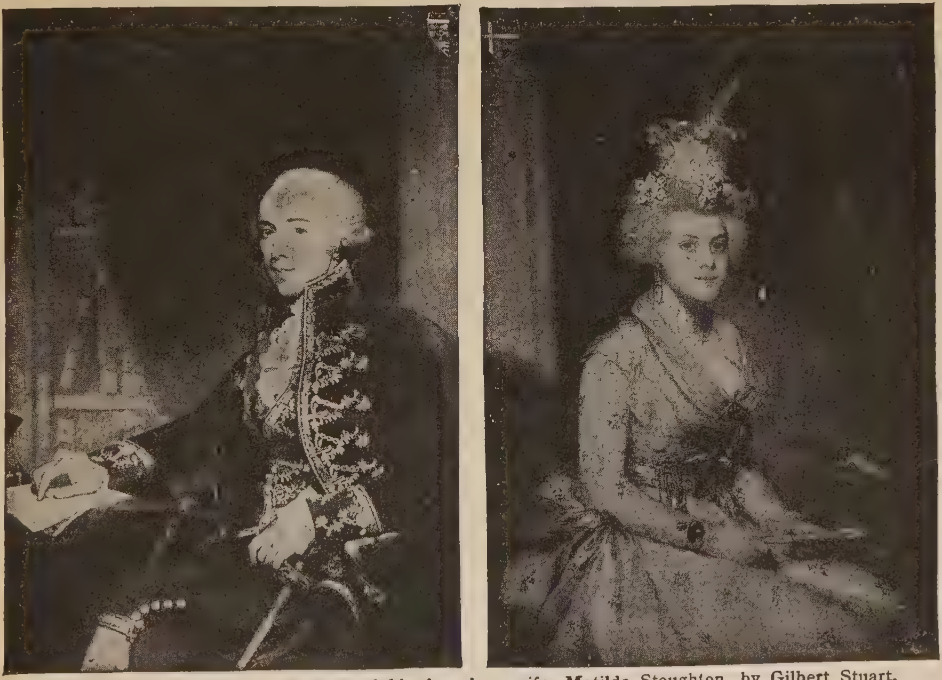
EIGHTEENTH CENTURY PORTRAITS



Mary Storer, by J. S. Copley.



General Nathanael Green, by John Trumbull.



Don Josef de Jaudenes y Nebot and his American wife, Matilda Stoughton, by Gilbert Stuart.

These four portraits by Copley, Trumbull and Stuart give us a good idea of the work of our early American painters. The pictures by Trumbull and Stuart are good examples of the artists' painting, but the portrait by Copley is stiff and a little hard. It is from pictures such as these that we have gained a knowledge of how our forefathers looked and what they wore, so that they are not only interesting pictures, but valuable historical documents.

All the pictures for this article except the portrait of General Greene, are from the collection of the Metropolitan Museum of Art, New York City.

enemy's works. He resigned from the army, went to France, then to London, where he, too, studied under West. He had a hard experience, for the English Government, indignant at the execution of Major André, threw him into prison for eight months and then ordered him out of the country.

The very stirring history then in the making, fired his imagination to paint great historical scenes such as The Battle of Bunker Hill. How highly esteemed Trumbull was in his day may be seen by the fact that Congress commissioned him to paint four paintings for the Capitol, for which $32,000 was appropriated, a far greater sum in those days than now.

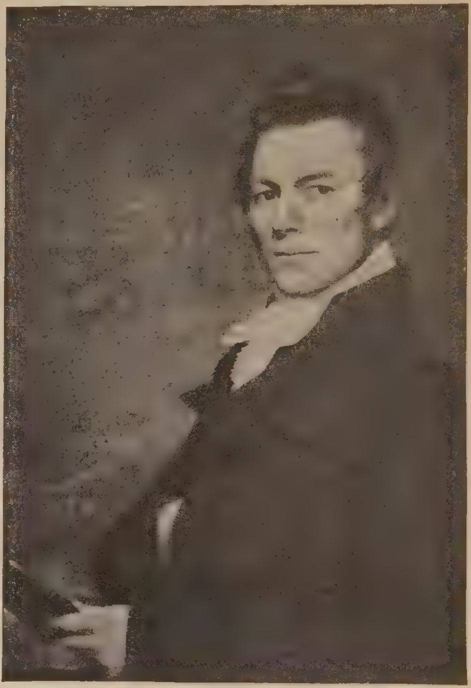
In studying the development of American painting, it is wonderfully interesting to see how with growing powers and growing opportunities, and also as the public developed artistic understanding, our artists reached out to fuller and more varied forms of expression.

Washington Allston was one of the first to develop real sense of color. He was one of the few Southern early American artists and was born in South Carolina in 1779. But he was educated north, at Newport, R. I., and then at Harvard.

Allston had the advantage of four years' study in Rome, where he enjoyed the companionship of many distinguished people, among them Keats, Shelley, Byron, and Turner. The life in Rome kindled his imagination, stimulated him, the critics say, to attempt more than his talent could perform. The Dead Man Restored to Life is one of his best known pictures. Even if his achievement was not great, as a man of high ideals and thorough training he favorably influenced American art.

Edward Malbone, who was a boyhood friend of Allston, was a miniature painter, whose work is prized almost as much as the work of the best European miniature painters. He died at the early age of thirty.

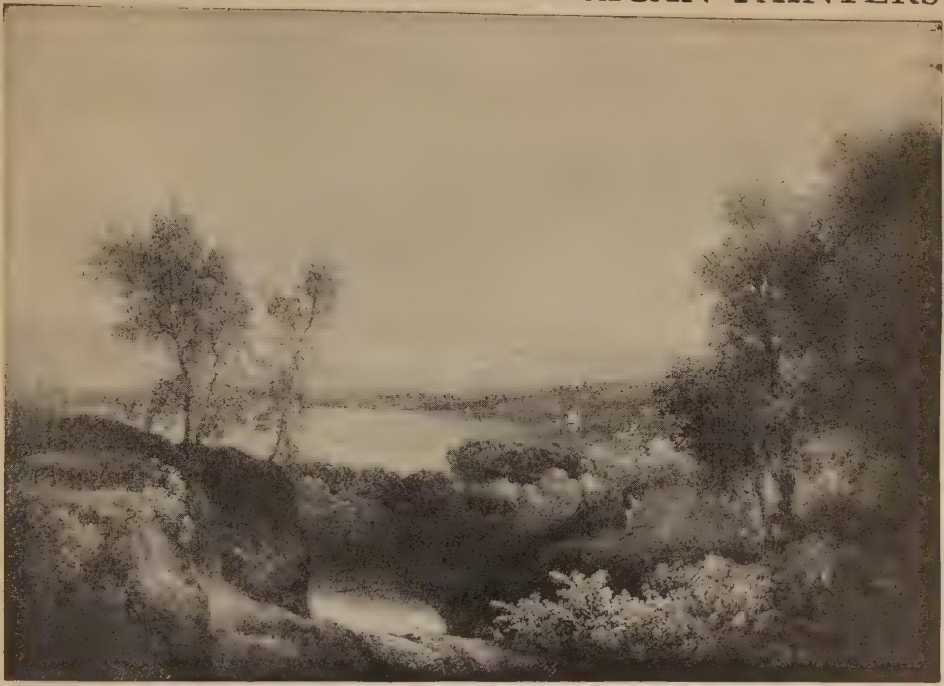
Although less well known than some of the other men of whom we have been reading, Thomas Sully was one of the best of our early American painters. He was not of American birth, having been born in England in 1783. He was nine years old when his father and mother, both of whom were actors, brought him to Charleston in South Carolina and made their home there. As a youth, he studied painting with his brother-in-law, a miniature painter in Charleston, and was afterwards a student of Gilbert Stuart's for a short time. When he was a young man he set up a studio in New York, but did not meet with success. He felt the need for more study, and, with a few hundred dollars, he went to London to work under Benjamin West. He stayed in London as long as his money lasted, and then returned to Philadelphia, where he lived for the rest of his life. He painted portraits of three of the presidents of the United States, and, after Queen Victoria began to reign in England, he once more went to London to paint her portrait for a society in Philadelphia.


Portrait of a Man, by Thomas Sully

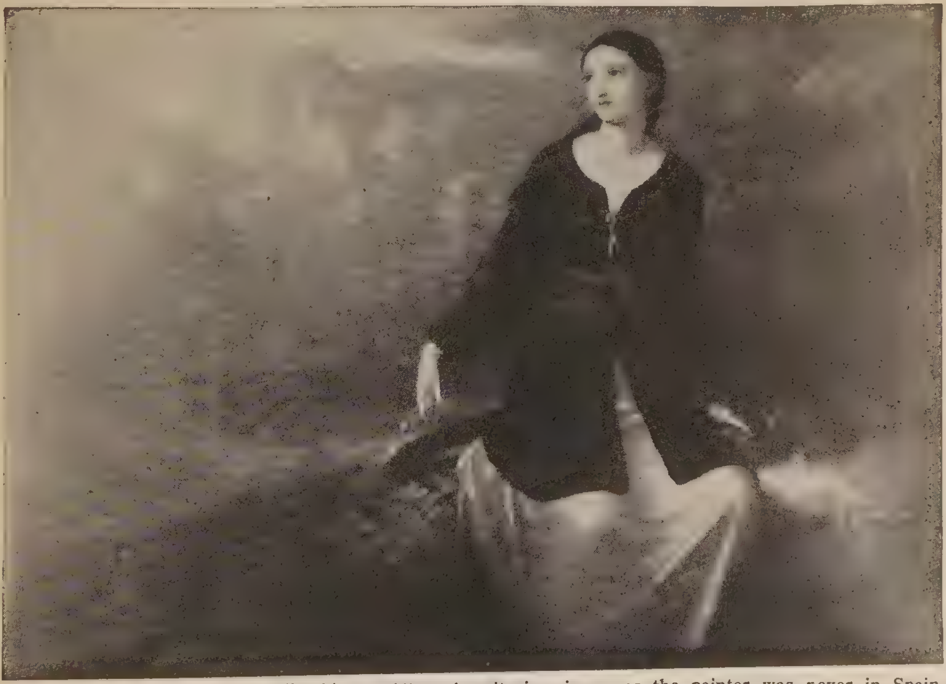
Sully did not draw very well, but his colors are warm and fresh, and his portraits are lifelike and without the stiffness given by many of the portrait painters of his time.

Before they had gone very far, American artists felt the need of banding together for enlightenment and encouragement. The very earliest Academy of Fine Arts, that of New York, founded in 1801, was soon discontinued for lack of money to support it. The next, that

PICTURES BY EARLY AMERICAN PAINTERS



This picture was painted by Thomas Doughty, the first American artist who began to paint what he saw out of doors. Unlike the artists of our time, he tried to paint every detail in the landscape. Even the leaves of the trees and shrubs are painted with great faithfulness. Doughty may be called the first of the national school of landscape painters. He did not begin to paint seriously until he was thirty.



This picture of a Spanish girl by Washington Allston is quite imaginary, as the painter was never in Spain. Allston had an excellent sense of color, but critics say that his talent was not great enough to enable him to carry out successfully the ideas with which his imagination teemed. The picture is a good illustration of the work of this artist, whose life and ideals had a good and enduring influence on American art.

of Philadelphia, is still enjoying an honorable life. In 1870, Boston incorporated its Museum of Fine Arts. The very next year the New York Legislature granted a charter to the Metropolitan Museum of Art and later the city made an appropriation for the Museum Building in Central Park. The more the people saw pictures, the more they loved them and wanted to own them.

THE HUDSON RIVER SCHOOL

All the men of whom we have been reading are remembered as portrait painters, but we now come to the founders of our school of landscape painting. The forerunner of this school was Thomas Doughty, who was born in Philadelphia in 1793. His life gives us a good idea of the difficulties encountered by artists in the early days of the country, especially after it seemed to be more than ever cut off by the Revolution from the culture of the Old World. Doughty began life as a leather merchant. He was thirty before he began to paint, except as an amusement, and was almost forty years old, and had gained a good reputation before he was able to travel abroad and study. He painted a good many landscapes, some of which have much charm. His chief claim to distinction is, however, that he was the first to draw the attention of American painters to the beauties of their own country.

As the number of our artists multiplied they sought helpful intercourse with each other. A group of painters who lived and worked along the Hudson in the early nineteenth century has been given the name of the Hudson River School.

Of these, one of the earliest and most famous was Thomas Cole. He was born in England, the son of a wall-paper maker, and came to this country with his family when nineteen. He first studied art at the Philadelphia Academy. From there he went to New York and then sketched and painted along the Hudson and in the Catskill Mountains until his work attracted the attention of the artists Trumbull and Durand. For a time Cole was very successful. He traveled abroad, and his work was exhibited in the Royal Academy. He painted great series of pictures in which his romantic imagination took the scenes among which he lived and made them the setting for a poetic allegory. One of these was The Voyage of Life. Another, The Course of Empire. They have a kind of story charm and are impressive from their very bigness. There is much beauty and feeling in the landscape part, but gifted though Cole unquestionably was, his style has long been obsolete. His name is generally associated with that of A. B. Durand, who was older than he was by some years.

A. B. Durand, who was born in the little town of East Orange in New Jersey, commenced life as an engraver, but after a time began to paint portraits, and after some years devoted himself to landscape painting. He may be said to have studied painting from the pictures which he engraved. He learned to draw very well, perhaps in faithfully copying the pictures which he engraved, but the composition, or arrangement, of his pictures is not always good.

These three men—Doughty, Durand and Cole—taught our artists to turn to landscape painting, instead of devoting themselves exclusively to portraits. Their work is not great, but most of it is good, and they have an important place in the history of our art.

Our artists were discovering how great and full of resources our young country was. We were proud of its bigness. The artists of the day sought great subjects. One of Albert Bierstadt's most famous paintings is the Yosemite Valley. Thomas Moran revealed the Rocky Mountains to the stay-at-home public, while F. E. Church painted Cotopaxi. From Trumbull's day we have had painters of historical scenes. Emanuel Leutze's present claim to remembrance rests chiefly on his historical painting Washington Crossing the Delaware. Leutze was born in Germany in 1816 but was brought to Philadalphia as a child.

Leutze had a pupil, Eastman Johnson, who became more famous than himself. Johnson was a New Englander, born in Lowell, Maine, in 1824. While still very young he became noted for crayon portraits, first in Lowell and later in Washington and Boston. He earned enough to take him abroad to study at Dusseldorf, then a very popular art centre. From there he went to Holland, where he studied Dutch art for four years. It influenced him greatly in choice of subject and in knowledge of color. He returned to America an accomplished artist, and his pictures of country life and of subjects suggested by the Civil War, became very popular.

For some time our artists flocked for training to the art schools of Munich and Düsseldorf. Then they began to seek Paris. Increasing knowledge of French art exercised a powerful influence upon them. The brilliant school of modern realism as seen in such works as Millet's made merely pretty pictures, conventional in treatment, seem tame and unsatisfactory. Our artists began to aspire to pierce through pretence and illusion and reveal genuine underlying truth. They wanted to show spirit as well as substance.

DISCIPLES OF FRENCH ART

For fifty years and more all ambitious art students have longed to go to Paris. Among the earliest of those to seek the Paris art schools were three of our most distinguished painters, William Morris Hunt, George Inness and John La Farge.

Hunt was born in Brattleboro, Vermont, in 1824. He was a delicate youth, compelled by ill health to leave his course at Harvard unfinished, and go abroad. He went first to Düsseldorf, where he joined the Art Academy, expecting to become a sculptor. Then he went to Paris, decided to become a painter and entered the studio of the famous Couture. Later he fell under the influence of Millet. The first taught him drawing and technique, the second taught him the greater lesson of sincerity and noble perception.

The time had come when American artists, unlike those of an earlier day, were unwilling to expatriate themselves for the sake of a more artistic atmosphere. Mr. Hunt returned to America, and after living for a time at Newport, R. I., moved to Boston, which became his permanent home. In spite of much admirable work he may perhaps be said to have helped American art more as teacher than as artist. His delightful personality won his pupils to his views and the ideals he held before them were of the highest.

The many-sided genius of John La Farge had every opportunity for development. Born in New York in 1835, he grew up in a home where books and art were greatly loved and appreciated, and which was a gathering place for gifted people. He was sent abroad when twenty-one, visited Munich, Dresden, and London, and in a long visit to Paris, met the most brilliant French people of the day.

Although greatly fascinated by modern French art, and in spite of his great talent, he had a strange reluctance to becoming an artist. He returned to New York and entered a lawyer's office. He said himself, "No one struggled more against his destiny than I." When he finally decided to devote himself to art, he went to Newport to study with Hunt.

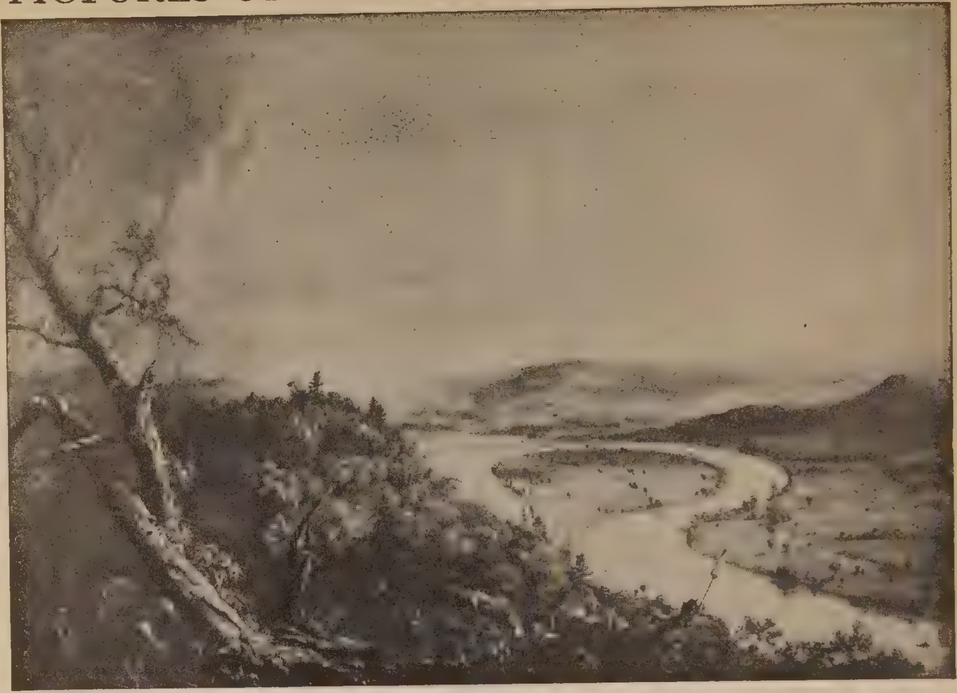
Much of his best known work is mural decoration. In this he was well served by one of his greatest gifts—wonderful sense of color and power of handling it. His predecessors believed that they had only to copy the colors of nature. La Farge analyzed and learned the effects of light on color. He was essentially a scientist, needing to know the how and why of effects. He says, "There is in each competent artist a sort of unconscious, automatic mathematician." Christ and Nicodemus, and The Golden Age, are among his well-known pictures. Young visitors to New York should see his great pictures in St. Bartholomew's Church and in the Church of the Ascension.

No one event ever had so great an influence on American art as the Centennial Exposition at Philadelphia. For there many American people had for the first time in their lives an opportunity to see great pictures. It was about the same time too that the first of our young artists to study in Paris studios were returning to begin their life-work in their own country. They brought with them new theories of art, very different from those hitherto accepted. As a direct result the Society of American Artists was formed. John La Farge was elected its first president, and its membership included many of whom America is now proud.

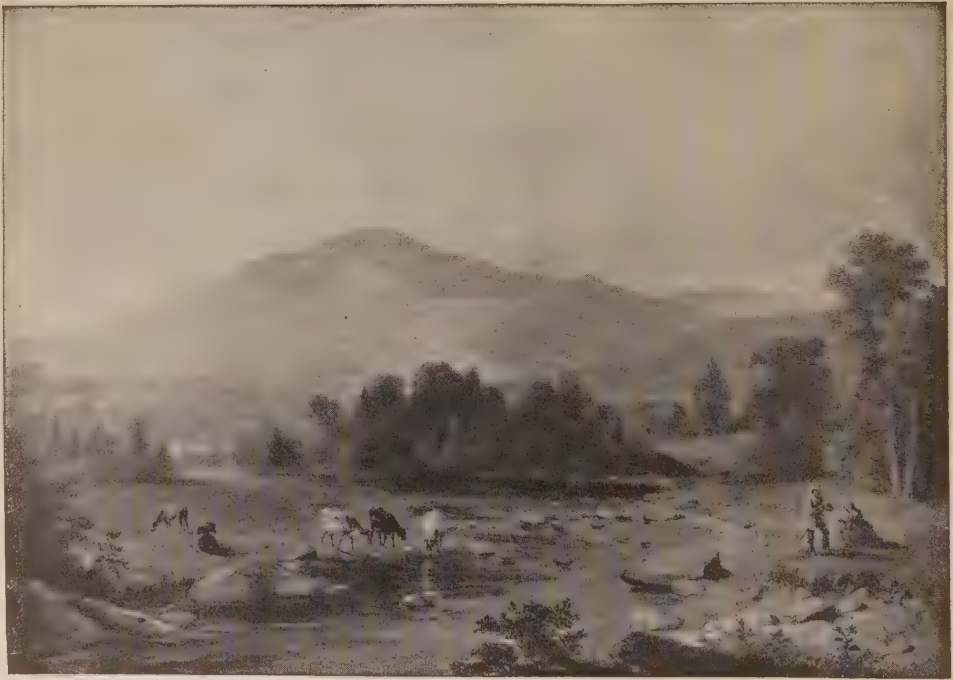
In his later life, La Farge turned his attention largely to the making of stained glass windows. He invented a special kind of glass to carry out his designs, and produced noble windows for Trinity Church in Boston. In this art he has been followed by Louis C. Tiffany, who was a pupil of George Inness, of whom we shall speak later on.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 4247.

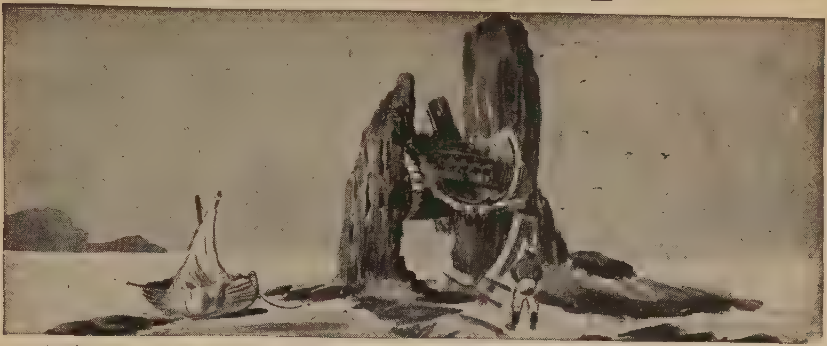
PICTURES OF THE HUDSON RIVER SCHOOL



This picture of the Connecticut River near Northampton gives us an excellent idea of the work of Thomas Cole. All the details of the scene are so clearly worked out that no one who had visited it could fail to recognize it. Every bush and rock is carefully painted and even the sheaves of grain in the field may be counted. Thomas Cole was one of the first among American artists to devote himself to landscapes.



A. B. Durand, who painted this picture, was the first really good American landscape painter. Like Cole, he painted every detail that he saw in the landscape. The chief value of his work is the beauty of his drawing, which you can even see more clearly in this reproduction than in the picture itself. Notice how beautifully the trees stand out in the foreground, and the clear line of the mountain tops against the sky.



THE TOILERS OF THE SEA

WE have read many famous books in English literature, and will turn now to some of the great novels of French authors. Victor Hugo is a romancer of world-wide fame; his is one of the most illustrious names in the literary annals of France. "The Toilers of the Sea" is not his greatest work, but it is the most suitable for our book, and it is a very fine story of heroism and self-sacrifice. It was written while the author was an exile in the Channel Islands, the natives of which are of French descent, though they are British subjects.

CONTINUED FROM 4142

AT the town of St. Sampson, in the isle of Guernsey, lived an old seaman, Lethierry by name. The pride of his life, his chief and only care, was his beautiful niece, Deruchette, whose future he meant to make happy and comfortable, so far as honest toil could ensure.

A man of unusual strength, he was accustomed all his life to great bodily exertion, and now, when he was engaged in the strenuous work of shipbuilding, he found himself at fifty years no longer able to lift his three-hundred-pound anvil with one hand! This made him think that he was not so young and vigorous as he used to be, and that he must lose no time in gathering together that little fortune for his niece.

Now, Mess Lethierry was not only a man of courage, as he had proved many a time in the teeth of vicious seas, but his good sense told him that when he was satisfied with a new idea it would pay him to be bold and risk every penny he possessed on it.

Thus he set himself confidently to the building of quite a new kind of ship, which, unlike all the others he had built before, was not to depend on sails, but on strange machinery worked by boiling water for its means of motion. There, day after day, in his shipyard at St. Sampson, he plied his skill and spent all his money on the making of this new ship, and when at last the wonderful engine arrived, and was fitted in its place, Lethierry had grown almost as fond of the Durande—for so he christened his boat—as he was of his adorable niece, Deruchette.

At length the great day came when, with much noise and the belching forth of smoke like a small volcano suddenly grown active, the Durande, its whirling paddles suggestive of monstrous fins to the simple fisherfolk, who had never before looked upon a steamship, began its new life as a coasting steamer. As it could carry far more cargo than the old-fashioned coasters, and do its journeys from port to port in much less time, the Durande was a success from the first.

The happiest days of Mess Lethierry's life had now come, for he felt himself the luckiest of mortals, as he stood there on his wonderful steamboat and directed it among the ports of the Channel Islands or across the often dangerous waters to the old pirate town of St. Malo, on the rocky coast of France. Happy and prosperous years passed thus, until the captain's joints were so stiffened with rheumatism that he had to give up the command of his boat to a clever sailor named Clubin, who was supposed to be as honest as he was skilled in the ways of the sea.

This Clubin, however, was noted for his honesty simply because he had not yet had an opportunity of proving what a rascal he was at heart. He had been patiently waiting for the chance to come when he might enrich himself at his employer's expense, and make off to some place where, with his ill-got gains, he might enjoy himself better than toiling in the stormy waters of the English Channel. To help him at the right moment, he possessed himself of a very cunning invention, which a man from America had sold to him, in the shape of a revolver. He knew that the time had come when this would enable him to play his master-stroke.

Clubin had brought the Durande into St. Malo, and it was there he meant to make his bold stroke for fortune. Armed with his revolver, he betook himself some distance from the town to a little wood close by the edge of a great cliff that threw its shadow far below on the waters of the Channel.

A VILLAIN'S MASTER-STROKE IN A GREAT GAME FOR FORTUNE

There, on the edge of the cliff, he saw a coastguard watching a vessel that lay some little way off-shore. A small boat was being rowed from the vessel towards the cliff. While the coastguard stood watching, a tall and muscular sailor crept from the shelter of the rock as silently as a cat, and, striking him a deadly blow between the shoulders, sent the unsuspecting watcher headlong into the sea. As the murderer stood calmly looking at the rippling circles where his victim's body had disappeared, Clubin stepped softly from his concealment, the useful revolver in his hand.

"You have just killed a man, Rantaine," he said quietly.

At this the murderer turned quickly, only to find himself facing Clubin's wicked little weapon.

"Stand where you are," said the captain, "for I have six shots here, and they may either kill you or alarm the nearest coastguard."

Dismayed and cowed by the warning click of Clubin's revolver, Rantaine asked what he would have of him. "Yesterday I watched you," said Clubin, in a voice of irritating softness, "while you went to a money-changer and got from him three English bank-notes for one thousand pounds each, in exchange for seventy-six thousand francs. This money you had stolen from Mess Lethierry. Then you arranged with the master of that ship out there to make good your escape. The notes are in your tobacco-box. Don't deny it; but just put your hand in your pocket and throw the box over to me."

DIAMOND CUT DIAMOND, OR TWO RASCALS AND THREE THOUSAND POUNDS

Never for a second did Clubin cease to cover the other villain with his revolver, and Rantaine, with many a vain curse, protesting that he was as helpless as a child before that thing, at length did as he was commanded. When Clubin had assured himself that the banknotes were safe, he said:

"You may go; your boat is near."

And down the perilous cliff the outwitted rascal scrambled. Once in the boat, he called back that he would write to Lethierry to say that he had paid over three thousand pounds for him to Clubin. The latter heeded not, but quietly returned to St. Malo. The first move in his great game had been won!

That night the master of the Durande began preparations for sailing next morning, though all the mariners expected it would be a day of fog, and he knew this as well as any. In the morning, however, as the Durande steamed away from port, the sky was so bright and the sea so calm that the prophecies of fog seemed foolish.

THE CAPTAIN OF THE DURANDE PREPARED FOR THE SECOND MOVE IN HIS GAME

For hours the vessel made its way, and the passengers on board had hopes of a calm and uneventful voyage, when suddenly a bank of fog was seen on the horizon. This increased until the steamer on its onward way had become engulfed in it. But there was no slackening of speed. The Durande still forged ahead. A feeling of uneasiness seized all on board when the engineer was heard to say to his assistant: "This morning in the sun we were going at half speed, and now we are ordered full speed ahead in the heart of the fog."

It seemed but a few moments after

this that the vessel struck on a great rock. It was as though the Durande had leaped from the waters and impaled herself on some strange mountain peak thrust up through the sea. But while all was excitement and disorder, the captain of the vessel was cool and collected. He had the long-boat quickly launched. Passengers and crew hurried into it.

THE WRECK OF THE DURANDE IN THE FOG IN THE CHANNEL

"Push off!" he called out, when urged by them to jump in. "I shall stay here, for when the ship is lost the captain is lost also!"

Little though the passengers and crew guessed it, as they pulled away in the ship's boat, this was the second move in Clubin's game for fortune. And, little though he knew himself at that moment, it had not succeeded. His scheme had been to steer the Durande on to a group of rocks only a mile from shore, and by swimming that distance, an easy feat to him, he would have gained a deserted part of the coast. At some lonely farmhouse he would get dry clothing, and later make his way to a distant port, so escaping with the three thousand pounds.

It was, therefore, with a terrible change from satisfaction to dismay that Clubin discovered, during a momentary lessening of the fog, that his vessel had struck the terrible Douvres rocks, full five-and-twenty miles from shore! Yet he did not utterly despair, as smugglers often passed near these weird rocks, and might take him off without question if he paid them well.

As the fog gradually lifted, and Clubin wished to take his bearings, he decided to gain the summit of the higher rock. To do so he needed to plunge into the sea and swim to the reef.

THE DOUVRES ROCKS AND THE DOOM OF THE WICKED CAPTAIN

Stripping himself of most of his clothing, and fastening a belt around his waist, with the precious tobacco-box, he dived from the wreck. The water was deep, and he dived well. But he did not come up again, for as he went down he had been seized by some strange thing, in whose grip was death.

The shipwrecked crew and passengers safely reached St. Sampson that night, and great was the consternation when it was known that the Durande had struck the Douvres. Lethierry could scarcely realize his loss. He was stunned, like one who has suffered a great bereavement. The captain of a cutter which came in later reported having seen the wreck and watched it in the now boisterous sea being hurled farther on the rocks, and held fast between the two giant pillars of the Douvres. There was no sign of Clubin anywhere. He thought that while the vessel's hull was beyond repair, the engine might be intact.

For a moment old Lethierry's spirits revived at the thought of the engine being saved. Only for a moment. He knew too well the terrible nature of these rocks, their scant foothold, and the almost incredible labor that would be necessary to cut the engine out through the wooden decks and plankings.

"No, it is all over," said the captain of the cutter, as if he were answering the thoughts in Lethierry's mind. "There does not exist a man who could go to these terrible rocks and save the machinery of the Durande."

THE FISHERMAN WHO WENT TO FIGHT THE SEA FOR THE DURANDE'S ENGINE

"If he existed," exclaimed Deruchette, who had been trying to console her uncle, "I would marry him!"

"You would marry him, mademoiselle?" said a tall young man, almost in a whisper, when he had made his way from the outside of the crowd, and stood before her. He was a fisherman named Gilliatt, so quiet and determined that many thought him strange.

The eyes of all were directed on him as old Mess Lethierry said, with great solemnity, that Deruchette should be the wife of him who could save the engine.

The next night the fisherman and lighthouse-keepers were speaking of some madman whom they had seen piloting a strongly-built sloop out through the most perilous passages of these rock-studded seas into the darkness. It was Gilliatt of whom they spoke; for he had determined to win the prize which had seemed beyond his wildest dreams. He was bound for the Douvres rocks, and he was taking the shortest way with all its dangers, as not a moment was to be lost in this battle with the sea.

Out into the dark he sailed, threading his way as none other would have dared. Out from the darkness to the dawn, and so into the broad light of day, which was shining on the grim and desolate Douvres when Gilliatt brought up his sloop there. The two giant pillars of rock held up the broken vessel almost like a nut in a nut-cracker. But Gilliatt had no time to marvel at the sight. Making fast his vessel, he sprang ashore and climbed to the wreck.

HOW GILLIATT BEGAN HIS BATTLE WITH THE SEA AT THE DOUVRES

His examination proved that the after-part, with the precious machinery and paddle-wheels still intact, had been driven firmly between the two upstanding rocks, while the fore-part of the vessel had broken off and sunk into the sea. Quickly the brave fisherman mapped out the situation, and determined on his plans.

There, once a dangerous passage had been overcome, was a piece of sheltered water where his sloop might rest secure. When the tide was low he could go between his own boat and the wreck by jumping from rock to rock, but at high tide the sea would cut off this connection, and, as it was impossible to make a shelter for himself on the wreck, all that he could do was to choose the top of the higher of the two rock pillars as a refuge during high water. To this he could climb from the wreck by throwing up a knotted rope to which he had fixed a grapnel.

In a cavern of the rock he slept the first night, and found when he awoke next day that his food-supply had been blown into the sea. Nothing daunted, he gathered some limpets, and, breakfasting off these, began his work in earnest.

THE TOILER OF THE SEA AND HOW HE MATCHED HIS WITS AGAINST NATURE

In one of the caves Gilliatt rigged up a rude forge with stones and material from the wreck. For he was no mere fisherman; he had all the resource and ingenuity of one born to outwit Nature with the invention of the engineer. His life as a fisherman and sailor had taught him how to do things in the simplest and most effective ways, and his natural ingenuity enabled him to invent methods of working on the wreck that made up for his lack of proper tools. But above all was the burning desire, the firm determination, to accomplish the great task he had undertaken, and so to be able to claim the loveliest of all the girls in Guernsey for his bride.

With the vigor of a giant and the industry of one who labored to save his very life, Gilliatt went about his task from day to day, supporting himself only by such food as the shell-fish about the rocks afforded. Bit by bit he took down the paddle-wheels and stowed them carefully away in his sloop. With rude saws and chisels, made from things in the wreck, he gradually cut away the decks and planking of the Durande, until her precious engine was exposed.

Seated on the rock with folded arms and anxious face, he now pondered over the greatest task of all. How to transfer the machinery from the wreck to his own sloop? He knew that if he could but lift it as one mass there would be room for it aboard his boat. With powerful tools it would have been an easy task, but without a single appliance of any power it meant a feat of engineering.

THE LABORS OF A TITAN AND HOW A FISHERMAN PERFORMED THEM

Four great beams of wood which he had saved from the wreck now came in handy. Hoisting these up by means of the capstan, he managed to wedge them between the two pillars of rock above the remains of the vessel. They were thus like the beams across a workshop roof, and from each one of them he hung a hoisting tackle. His next movement was to cut four holes in the deck on the starboard side of the engine, four on the port side, and a hole corresponding to each of these through the keel. Cables were then passed through the deck-holes, through those in the keel, and carried across the bottom; then upward through the holes on the opposite side, and back to the hoisting tackles. All four tackles, with their cables, were now brought together at one point of the beams, and held by a single tackle, so that one hand could control the lot.

The heroic labors of the fisherman were still far from being finished, though the progress he had made was worthy of a Titan. For more than two months had he labored at this wild and strange task all alone. No one would have known him, so terribly had he changed as a result of his toiling in the sea. His beard had grown, his hair was long, all over him were cuts and bruises. His food had been nothing but shell-fish, his only fresh water the rain and dews that gathered in the crevices. Hunger was ever gnawing within him, thirst seemed to have him always by the throat, and he suffered all the time from cold.

HOW THE ENGINE WAS TAKEN OUT AND LOADED ON THE FISHERMAN'S BOAT

Only the fact that Gilliatt had an intelligence far superior to that of the ordinary fisherman could have kept him at his terrible task. The sufferings to be endured from day to day would have daunted even a brave man, and in his unequal battle with the sea, only the inventor's delight of seeing his plan succeed held him to his task—that and the quickening hope that one day soon he would return to St. Sampson, a man of note for his achievement, and have the most charming girl in all Guernsey for his wife. Thus was he buoyed up in his work, and so he toiled along, enduring his hardships for the sake of the prize he now saw coming nearer day by day.

It was only after enormous toil and by fixing a series of great spikes into the rock, to which he attached some immense pieces of the wreckage that made a sort of swinging gate across the narrow defile between the two pillars of rock, that Gilliatt ventured to bring round his sloop from its safe anchorage to this perilous position below the wreck of the Durande. His plan was now to guide the great mass of machinery and planking, which was held suspended by the cables from the beams, on to the deck of his stout and capacious sloop.

How this was done it is difficult to tell, and for a moment it looked as if all his ingenuity would only result in the foundering of his sloop; but, to his great joy, the straining pulleys ceased to creak, the cables slackened, and the engine was safely deposited in the sloop.

GILLIATT'S LAST GREAT BATTLE WITH THE WAVES AND WINDS

Gilliatt had but a brief time wherein to contemplate with satisfaction the success which had crowned the labors of his brain and hands. There was a sudden stirring of the waters, a rising of the wind, heralding the coming of a tempest, long delayed. Once more had Gilliatt to prove himself a giant toiler. His first care was to swing his gate across the defile and lash it securely with chains and cables. Then, swimming and wading to the outer rocks, he threw up, by means of beams and chains, a rude breakwater, so that when the tempest broke in its fullest fury on the Douvres rocks, his sloop with the precious engine aboard would have at least the protection of the gate across the defile and this rough breakwater.

When the tempest let loose all its mighty forces of wind and rain and lightning on the Douvres, it found a weird and haggard figure of a man ready to do battle with it. And for twenty long and raging hours did Gilliatt match his wit against the brute fury of the elements. Now, by breaking down some part of the wreck, he made a barrier at the other end of the defile; again, by dislodging a massive piece of rock with a beam, and letting it roll into the seething waters, he just saved his breakwater from ruin.

At last the tempest ceased, almost as suddenly as it had begun. The blue sky was above him again; Gilliatt had won in his battle with the waves and winds. So, lying down on the deck of his sloop, he slept from sheer exhaustion, and when he awoke it was to realize his great hunger rather than to rejoice in the successful issue of his toils.

A STRANGE ADVENTURE IN A WEIRD CAVERN OF THE SEA

Stripping himself to the waist, he left his boat and climbed on the lower part of the reef, where he saw a large crab go under a great shelf of rock. Putting his knife between his teeth, he crawled after it, and, to his amazement, found himself in an underground cavern where he could stand up.

It was a weird and mysterious place, the existence of which in all his days upon the rock he had never before suspected. There, in the centre of it, was a strange, uncanny pool of green cold water, whence great pillars of rock arose and disappeared in the gloom above. All around him were the waving leaves and tendrils of strange sea growths. It was a place to strike dumb terror to the heart of the bravest. But Gilliatt was undaunted, and his hunger goaded him to find the crab that had led him there.

Wading into the water of the sullen green pool, he was groping about in the rock crevice where the crab had disappeared, when suddenly he felt his arm seized by some living thing! Around his naked arm he felt this thing twisting, rough and flat and cold and slimy. It was creeping up towards his chest, tightening like a cord. He tried to pull away a little, but found that he could scarcely move, as the thing that held him was as supple as leather, strong as steel, and icy cold.

THE FISHERMAN'S FIGHT WITH THE GIANT CUTTLEFISH

Then from the hole in the rock whence this mysterious thing had come there came another that wound itself about him, creeping over his skin with innumerable flat, round points that stuck to him like suckers, and caused a strange sense of pain.

From the crevice of the rock there came another, and yet another of these awful living thongs, that bound him helpless, and a fifth had fastened on him before he could dimly see the horrid shape of the monster, with its two great eyes set in the middle of its short and pulpy body. He was in the grasp of a great cuttlefish, or devilfish, as it is sometimes called.

Its tentacles held his right arm powerless, and it was advancing towards him, with its parrot-like jaws ready to fasten on his side. Then, indeed, there had been an end of Gilliatt and his plans; but, with a rapid sweep of his free hand, in which he had his knife, he quickly severed the hideous head of the uncouth creature, and immediately he felt its tentacles relax.

He had freed himself, and was about to flee from this cave of terror, when he noticed, partly buried in a heap of crab-shells, a skeleton with a belt around its waist. He pulled at this, and as it fell apart he found himself with a small iron tobacco-box which enclosed some pieces of paper.

THE TOBACCO-BOX THAT GILLIATT FOUND IN THE CAVE OF THE DOUVRES

They were the three thousand-pound notes. This had been the end of Clubin! Gilliatt's knife had enabled him to escape the same terrible death.

It was two days later that Gilliatt arrived in the dusk at St. Sampson, and moored his boat close by the house of Mess Lethierry. All that he had hoped to do was done. He had achieved what others had believed to be the impossible. He had suffered, he had won. Yet nobody knew he was there. He went very quietly to peep into the garden, where he hoped to see Deruchette. There she was, but not alone. There was a stranger with her, who held her in his arms, and she seemed to love him. Poor Gilliatt saw this, and moved away without a word.

Nothing can describe Lethierry's delight next day when he realized that the precious engine of the Durande had been salved. He behaved like a man possessed. There was nothing too extravagant for him to say of Gilliatt. The man who saved the engine was to marry his Deruchette, and he meant it. But he did not know what Gilliatt had seen. He did not understand why the young fisherman said "No!"

And so it came about that Deruchette was married to the man whom Gilliatt had seen with her in the garden on his return. They sailed away from St. Sampson, and, standing on the deck to take a last look at the old town, she said to her husband:

"Look! It seems as if there were a man out there on that rock."

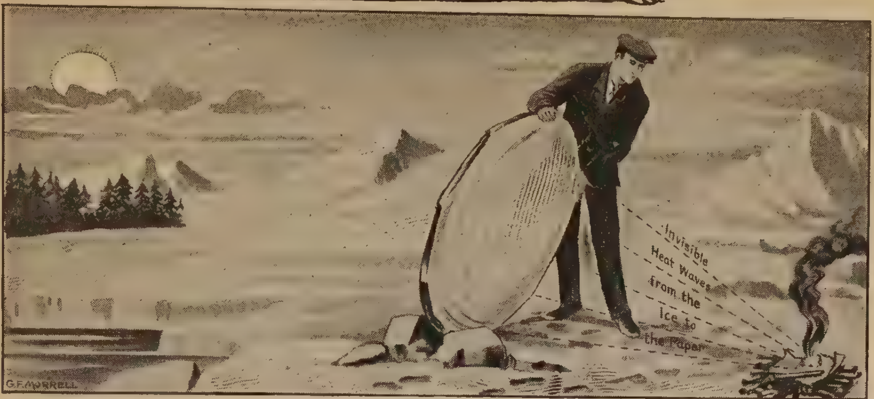
GILLIATT'S LAST SIGHT OF DERUCHETTE AND THE END OF IT ALL

There was, indeed, a man upon the rock, sitting motionless, as the vessel passed out from the harbor, and the man looked wistfully towards the lovely face of Deruchette. Many a time before had he sat in that same place. It was a sort of natural chair hollowed out of the rock by the action of the sea, and at high tide the water rose above it. Gilliatt, in the old dreamy days, had often sat there gazing out to sea, dreaming, until the rising tide warned him to be off. The water was rising now, but he did not heed it. The waves had reached the waist of the man when Deruchette drew her husband's attention to him. The water was now nearly level with his shoulders; but his eyes were fixed seaward on the diminishing vessel, and a strange light shone in their profound and tragic depths. One could read there the melancholy acceptance of an end far different from the dreams the man had cherished.

The vessel had become a mere speck now on the horizon, and when it vanished the head of Gilliatt disappeared altogether. Nothing was visible but the far-gleaming sea.

THE NEXT FAMOUS BOOKS ARE ON PAGE 4315.

The Story of THE EARTH.


Invisible Heat Waves from the Ice to the Paper
G.F. MORRELL

If the sun's rays be passed through a slab of ice shaped like a burning-glass, the heat waves retain their heat although the ice is so cold, and will light a fire of paper and wood, as shown here.

DIFFERENT KINDS OF HEAT

CONTINUED FROM 4088

WE have discussed the first great fact about heat, which is that it is a particular kind of motion of the particles of matter, and therefore we must be able to imagine that matter might exist without this motion—that is, absolutely cold. This discovery of the nature of heat is one of the great discoveries of modern knowledge.

But now many of us who have read so far will want to ask a very serious question, because we see very well that either something has been missed out from what we are saying, or else words are being used with very mixed-up meanings. What we ought to ask ourselves is this: Seeing that heat is a particular kind of motion in matter, and that when we get outside our ocean of air there is no matter between us and the sun, what is that heat which the sun sends us?

The reason for the difficulty, as we have already mentioned, is that the word heat is being used with mixed-up meanings. When we look at the facts, we shall see that there is much excuse for the confusion, but still it is a confusion. We have to admit at once that the word heat is used for two different things—first, for a particular kind of to-and-fro motion in matter; and, second, for a particular kind of wave in the ether. So now, before we go on to any details, let us look in a general way at this other kind of heat, as we have done in the case of the first kind of heat. The rest will be all plain enough if we get right ideas at the start. For the moment, let us quite forget what we know about the heat which is a motion in matter; or, if we do not forget, let us assume that the word heat is now being used as a quite different word.

Everywhere there is the ether. Throughout all space, whether matter is there or not, there is the ether, that can be thrown into waves. These waves are of different shapes and sizes, but they are all of the same nature, and all travel through the ether at the same rate. Different parts of our bodies pick out certain sets of these waves, and then we call them by special names. For instance, our eyes pick out a group—not a very large group—of these waves, and see them; those waves, then, we call light waves.

Close to them in the great scale of ether waves are others, really of just the same kind, which, as it happens, our eyes are unable to see, and which, therefore, we do not call light. But other parts of our body can feel them, and the feeling they give us is one of warmth or heat. So we call them heat waves. If we use the modern term, which is being employed more and more, we shall say that the ether conveys *radiations.* In the mighty scale of the ether radiations, which we may compare with a series of notes on a piano, the heat radiations lie just below the light radiations. The two are in all essentials the same; they differ only as one octave on a piano differs from an octave next to it. Radiant heat and radiant light both travel through the ether at exactly the same speed—namely, about 186,000 miles a second. They come together to us from the sun.

SOMETHING THAT THE THERMOMETER CAN FEEL WHICH OUR EYES CANNOT SEE

It is possible to spread out the radiations from the sun by passing them through a prism—a three-sided piece of glass. When this happens, the radiations are all spread out in their proper order, and if we take a thermometer it is very easy to show that on one side of the patch of light which passes through the prism, and in the darkness just beyond it, there is something which our eyes cannot see, but which the mercury in the thermometer can feel, so to speak, and that is the radiant heat coming from the sun.

Now, we shall best understand the uses of the word heat, and the way in which things really happen, if we trace the course of things from the sun, say, to our own skin, when the sun's warm rays fall upon our faces. Let us suppose, for the moment, that we are blind, or have our eyes shut; we are not to consider the light waves at all, but only the heat waves.

The sun is made of matter; and the matter of the sun, like all other matter, is made of atoms and molecules. These, in the case of the sun, are intensely hot. We should have to represent their temperature at thousands of degrees.

MOVING ATOMS IN THE SUN THAT CAN KILL A MAN ON THE EARTH

Now, we already know what this means. It is that the atoms and molecules of the sun are moving very quickly to and fro in a special way which makes heat. The question is: How does that movement, more than ninety millions of miles away, affect us? For, walking on the earth, we may be actually killed by sunstroke, because at that immense distance certain atoms and molecules are moving very quickly backwards and forwards. This can be explained, and the explanation applies equally to the case of the sun, or to the case of a warm fire which sends across the room heat that we can feel.

We are to remember that the ether is everywhere. Let us for the moment think of it as an ocean in which everything is buried—the sun and the earth, and everything else. Now, the atoms and molecules in the sun or in the fire, as they move quickly to and fro in this ocean of ether, may very well start waves in it, just as a fish's tail would start waves in water. And those waves are the radiant heat which travels through millions of miles in the ether from the sun in every direction equally, and of which a very tiny proportion is caught by the earth and the people upon it.

Fortunately for us, before these powerful rays reach us, a very great quantity of them is stopped and kept by the atoms and molecules of the air which floats above us. None of us could possibly survive the sun's glare if there were not an ocean of air above us to catch a great deal of it.

THE WAVES OF ETHER FROM THE SUN THAT GIVE US HEAT

Now, what happens when the air, or anything at the bottom of the air, such as a stone or a sheet of water, receives these rays from the sun? The wave has traveled through the ether from the matter which made it, and has struck other matter. In that matter it produces the same kind of motion as that which made it in the first place, and so the heat of the matter of the sun produces heat in the matter of the earth.

It has probably not been pointed out before how close is the parallel between what happens in this case and in the case of the telephone. When we speak into the telephone, certain to-and-fro motions are made in the matter there, which we call the drum. These motions do not run along the wire, but they produce in the wire an electrical wave which is not really a wave in the wire at all, but in the ether in the wire, and which is really of the same kind as a wave of light or of radiant heat. At the other end of the telephone there is another drum, which is made to vibrate to and fro like the drum into which the words are spoken. Just in the same way, the ether waves that are started by the hot matter of the sun strike the matter upon the earth, with the result which we call heat. We have a very good instance of this when we use a burning-glass. We know that if we have a rounded piece of glass, we can make it throw a bright spot upon a piece of paper, and that we can even cause the paper to burn in that way. The glass has acted not only upon the light waves, which we can see, but upon the heat waves, which we cannot see; and when the paper is thus heated to a sufficient degree, it combines with the oxygen of the air, and we say that it burns.

In these last sentences, the word heat has been used in its two senses; but we have now studied the subject far enough not to be confused, and we understand the very great and complete difference there is between that special motion of the atoms of the paper which we call heat, and those waves of the ether which are a kind of invisible light, and travel through millions of miles of space where there is no matter.

THE KIND OF HEAT THAT MOVES IN MATTER IN TWO DIFFERENT WAYS

Here, it is not necessary to say any more about radiant heat; but of course we shall have to refer to the important subject again when we come to study light. Now let us go back to the heat which is a motion in the atoms or molecules of matter, and which might indeed, to distinguish it, be called atomic or molecular heat.

This kind of heat, as we have all observed for ourselves, can travel about in two ways, and now that we know what it is, there is no difficulty at all in understanding how it travels. Let us take the case of the water in a kettle which is being heated.

We can imagine the special kind of motion called heat being imparted to the molecules of water that lie nearest the bottom of the kettle. It may then be, as indeed it is, that these molecules rise to the surface of the water, and as they rise of course they carry with them their heat. Now the heat which was applied to the under surface of the water has reached its upper surface. It has been bodily carried, so to speak, through the water; and when heat is carried in this way we say that this is a case of *convection*. This is an uncommon but quite simple word, if we remember the word vehicle. These two words come from the Latin *veho*, I carry; and so convection, or "carrying with," exactly expresses the way in which heat travels when hot particles moving about from one place to another carry their heat with them.

MATTER THAT CARRIES ITS HEAT AS A BEE CARRIES ITS BUZZING

We may think of this, perhaps, if we care to, as like the case of a buzzing insect. The buzzing and humming are due to the vibration of its wings, and as it flies about it carries the buzzing and humming with it. So we may think of the molecules of matter as buzzing. That buzzing is their heat, and when they travel of course they carry it with them. If we think of it in this way, we shall not be confused when, in a little while, we go on to study another way in which heat travels.

Convection of heat is an extremely important subject in our lives, and in the Story of the Earth. We understand, of course, that it applies only to fluids—that is to say, liquids and gases. In them the matter is flowing, and so it can carry its heat with it; but in anything solid the atoms and molecules stay in their places, even though they may be very hot and vibrating to and fro very quickly in their places. So no convection of heat occurs in solid bodies, but in all fluids convection currents are practically always going on. This well-known fact works out in a thousand different ways.

HOW OCEAN CURRENTS AND THE CURRENTS OF AIR ARE CAUSED BY HEAT

In the case of the water in the kettle, the heated water rises. It does this because heated water is lighter than cold water. Therefore, by heating one part of the body of the water, we can set the whole body of the water moving, and this applies not only to the kettle, but also to the oceans. It applies equally to other fluids, such as the atmosphere. In all the water of the earth, and in the earth's great coat of air, different parts are at different times heated more or less than other parts, and so convection currents are started. The results are very important, not only because heat is carried about from place to place, but because the matter carrying the heat is also moving about. In this way great ocean currents, and also great air currents, which we call winds, are started. There are constantly going on, for instance, what are called the trade winds, so called because in the old days, when ships were driven by the wind, the ocean trade of the world largely depended upon them. These trade winds depend entirely upon the laws of heat which we are now studying. If we think of the earth as a whole, we shall see that the tropics, being more directly exposed to the sun, are heated more than the temperate zones.

The air of the tropics, then, being heated and made light, ascends, carrying with it its heat. But as it ascends it leaves a space beneath it, and that space is filled by colder and heavier air flowing in to take its place. So there is set up a wind blowing from the north toward the tropics, and also one blowing from the south towards the tropics. If the earth were stationary and did not spin, these winds would be due north and south; but the earth is spinning, and any point at the tropics is moving round much faster than any point in either of the two temperate zones.

THE MEETING OF THE WINDS THAT USED TO CARRY THE TRADING SHIPS ALONG

This means that the apparent direction of the wind is altered, owing to the spinning of the earth, and, in consequence, the trade winds are not north and south, but in the northern hemisphere they are north-east, and in the southern hemisphere they are south-east. The two winds meet along a belt round the middle of the earth, and in the old days when ships got into this belt, where the two winds meet and cancel each other, so to say, sailors might be becalmed for long periods of time. The trade winds, though at one time important, are of practically no importance now, but the study of them in relation to the laws of heat is very interesting.

Now let us consider this law of heat as it affects the ocean. Here is a fluid of which the different parts can move freely, and they will carry their heat with them by what we have learned to call convection. The hotter water will rise because it is lighter, and cold water, which is heavier, will flow in underneath it, just exactly as we have seen in the case of the trade winds, in that other ocean which we call the air.

The consequences in the case of the ocean of water are very important, for the laws of heat so work out in this case that cold water, which was near the surface in the Polar or even the temperate regions of the earth, but especially in the Polar regions, travels towards the warmer regions of the earth, but is compelled to sink as it does so, having above it the warmer water, which has been exposed to the heat of the sun in the far warmer zones.

THE EVER-MOVING STREAM OF COLD WATER THAT GIVES LIFE TO THE OCEAN

Thus, in the great circulation of water on the earth which is always going on, we have to think of something rather like running a stream of cold water into one end of a bath filled with hot water. The cold water simply creeps along the bottom. Now, that is what happens in the case of the ocean, and the enormous importance of this fact is that the life of the deep-sea fishes, and the life —animal and vegetable—everywhere covering the ocean floor, depend entirely for their existence upon this stream of cold water. When it was at the surface it obtained oxygen, and that oxygen, which it carries to the depths, sustains all the life there.

One more instance of the convection of heat is, perhaps, the most interesting, and is certainly, in some ways, the most important of all. It is not to be found in any of the ordinary books on this subject, perhaps because most of the people who study these subjects confine themselves to studying only one view of them. If we examine our own bodies, or the body of any warm-blooded animal, we find that their temperature, or warmness, as we may say, is nearly the same at all parts.

THE BLOOD THAT MOVES IN OUR VEINS AS WATER MOVES IN THE SEA

Now we know that the heat is not made in, for instance, the hands or the feet, but only in certain organs in the inside of the body, and in the large muscles when they are thrown into action. How, then, is the heat distributed, so that the whole body is kept warm? The answer is that the circulation of the blood, wonderful in a hundred other respects, also supplies a beautiful instance of the convection of heat. The outlying parts of the body could not be kept nearly warm enough without this process of convection, for they lose heat to the outside world far more quickly than it could be received by that process. But the blood, which rapidly travels throughout the whole body without ceasing, carries to the surface and the limbs and other exposed parts, such as the ears, not only oxygen and food, but also heat, and then, as it flows through the small blood-vessels in these parts, the heat which has been bodily carried there by the blood leaks through into the tissues and keeps them comfortably warm.

HEAT THAT IS ALWAYS PASSING TO AND FRO BETWEEN DIFFERENT THINGS

Now that we perfectly understand the convection of heat, we can go on to study another of the very important ways in which it travels, and that is what is called *conduction.* The conduction of heat occurs in all circumstances, on solids, liquids, and gases, from solids to liquids, from gases to solids, and so on.

It is the constant law, true everywhere and always, that, whenever one thing is hotter than another, heat will flow from the hotter to the colder. Just as we say that water must find its own level, because of the constant action of the earth's gravitation, so we may compare heat with water, and say that it must find its own level. The constant tendency of heat everywhere is to make its level equal. Every portion of matter everywhere which is hotter than its surroundings must lose heat to them, just as a river must run downhill.

HOW A ROW OF BOYS CAN SHOW THE WAYS IN WHICH HEAT TRAVELS

Now, we must first understand what conduction actually is, and how it differs from convection. In conduction, the heat is passed on, or conducted, but the matter which contained it stays where it was. It is like a row of boys in which each one is slapping the next; whereas, in convection, the boys would change places and take their slaps with them. If we remember what heat is, we can begin to imagine how the buzzing, or vibration, of the atoms at one end of a poker might start the atoms farther along vibrating also in the same way, and so the buzzing, or heat, would be conducted along the poker. It is not possible to go more deeply into the nature of conduction than this, because we really do not know how the atoms or molecules of matter are held together in a poker or in anything else.

But we can, at any rate, study conduction in many ways, and the first thing we find is that different kinds of matter vary enormously in their conduction of heat.

Everyone knows that one end of the poker becomes hot when the other end is held to the fire. Yet one end of a piece of firewood may be so hot as to be actually burning, and the other end quite cool, though the stick is far shorter than the poker. The metals in general are very good conductors of heat, as the iron of the poker suggests. On the other hand, tissues made by living things are very bad conductors of heat. Wood is such a tissue, though we do not always think of it as if it were, and we have noticed how badly it conducts heat. Bone, also, and wool and silk, and even linen and cotton, always conduct heat very badly.

WHY IT IS NECESSARY FOR THE BLOOD TO CIRCULATE IN OUR VEINS

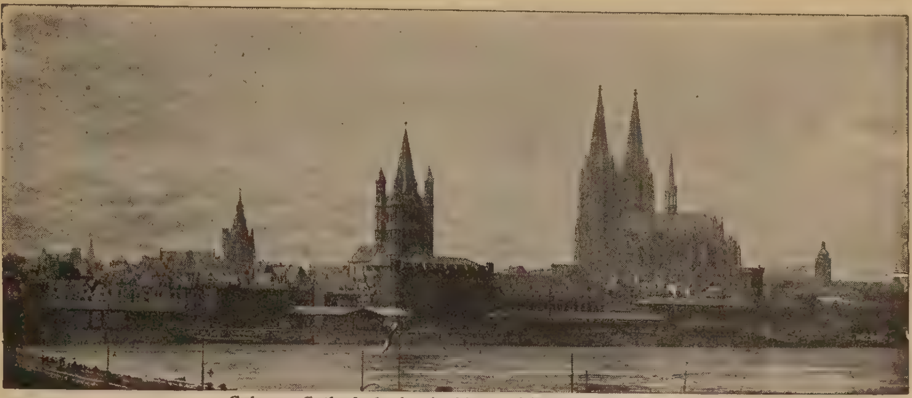
This general fact about the tissues of living things shows us how necessary it is for the circulation of the blood to play the part we have just studied, for our bodies are such bad conductors of heat that the heat made in the liver and muscles could not keep the whole body warm if it were not that convection is called in to the aid of conduction —first, we have quick convection by the blood, and then we have conduction through the finest blood-vessels to the tissues.

Though we have to rank the group of the metals as good conductors, yet even among themselves, they vary a good deal. Those which conduct heat best are those which conduct electricity best—for instance, copper and silver. The fact that living tissues conduct heat badly is by no means a disadvantage; it is a matter of the greatest importance to all warm-blooded animals that they are able to produce, by the life that is in them, special kinds of tissue which are very bad conductors of heat, and with which they clothe themselves.

THE NEXT PART OF THIS IS ON PAGE 4309.

THE RHINE ON ITS WAY TO THE SEA

Water gives us some of the most beautiful pictures in the world. This striking scene is a photograph of one of the mightiest rivers in Western Europe, the Rhine, in Germany. A photograph taken from the same spot one second later or one second earlier would be entirely different, so rugged are the rocks over which the river rushes on its way from the highlands into the lovely valley that it has carved for itself on its way to the sea. To sail along the Rhine is one of the greatest pleasures a traveler can have, so fertile and beautiful has this great river made the country through which it passes. (Photograph by Ballance)



Cologne Cathedral, the Architect of Which is Unknown.

LEGENDS AND TALES OF THE RHINE

CONTINUED FROM 4126

THERE are many rivers larger and longer than the Rhine, and perhaps some are more beautiful, but no other river has so many stories and legends connected with it. Every hill or mountain, cliff or castle, has its own particular story. Some of them are true, but often they are merely interesting legends or tales that have been passed on from one generation to another.

THE LEGEND OF DRACHENFELS

An interesting legend is attached to Drachenfels, or the Dragon's Rock, which is situated on the right bank of the Rhine. Half way between the base and top of this crag was a dark cavern, known as the Dragon's Cave. Here dwelt a hideous creature, half beast and half reptile, which ate nothing but human flesh. The pagans in their ignorance worshipped the dragon, and often gave as food to the dragon the Christians they captured from the opposite bank of the Rhine. Two pagan princes, Ronsik and Horwald, were accustomed to divide their captives, each one sacrificing a certain number of human beings. One day, while at this task, they noticed a beautiful Christian maiden who won the hearts of the princes by her charm and helplessness. Each wanted the maid, not as a sacrifice to the dragon, but as a wife. They quarreled fiercely but finally decided that it was not dignified to quarrel over a mere girl. It was then decided to offer the maid as a sacrifice to the dragon, and the following morning was chosen as the time for the ceremony. When the maid was told of her fate she prayed for strength to meet her end. Early next morning the princes and all the people in the neighborhood escorted the girl to the Dragon's Rock and waited impatiently for the monster to appear. Ronsik watched the maiden with pity, for he loved her, especially since she was willing to meet her fate so bravely. Suddenly a loud roar was heard and the dragon rushed forward to seize his prey; but as he advanced the maiden held out her crucifix, and with a piercing cry, the dragon turned aside and plunged into the Rhine.

The people, astonished at the power of the cross, begged to be converted to Christianity. Among the first to adopt the Christian religion was Ronsik, who married the maid and built a home for her on the Drachenfels, which is now known as Castle Drachenfels.

This cave has another story. If you

Copyright, 1918, by M. Perry Mills.

have read the story of Siegfried you remember that he killed a fierce dragon. People used to believe that Siegfried's dragon also lived in the cavern in this mountain.

EBERNBERG

You will be surprised to hear that Ebernberg means castle of the wild pig, but when you learn the reason for this strange name, you will surely understand. On a steep cliff not far from Kreuznach, there stands an immense castle. Many years ago, the lord of the castle, upon awakening, found his castle surrounded by enemies. The count knew that they could not capture his home, because the moat, or deep ditch, surrounding the castle, was too steep and the walls too thick and high; but they could prevent the people in the castle from procuring food.

The siege lasted for many days and finally starvation for all was near. The count finally went into the stable and brought out a wild pig, which he had caught alive. Taking the pig to the outer wall he pinched and pricked the animal until it began to squeal. He did the same every day until a week had gone by. The enemy, hearing the squealing every day, said: "We can never starve them out, they have too many pigs." Discouraged and disappointed they went away. The wild pig had saved the castle.

RHEINSTEIN AND REICHENSTEIN

The castles of Rheinstein and Reichenstein are situated very close to each other and there is an interesting story connected with them.

Many years ago Rheinhard of Reichenstein was deeply in love with the beautiful Hinda of Rheinstein. Now Hinda's father was very wealthy, but Rheinhard had only a small castle and very little money. Nevertheless he presented Hinda with a beautiful ruby, which had been in his family for many years. The maiden seemed very much pleased, and finally the young lord, unable to restrain himself, declared his love to the golden-haired beauty. She promised to marry him just as soon as her father consented to the match.

According to the custom of the times, it was necessary for Rheinhard to send as an embassy to the castle of Rheinstein one of his most distinguished relatives. Now the only kinsman anywhere near was a wealthy old uncle, Ludovick by name. This false old man was delighted to go to the court of Hinda's father, but when he arrived there, instead of demanding Hinda's hand for his nephew, he declared his intention of marrying her himself. Hinda was in despair because she wanted to marry her lover and hated the uncle. Her father, however, wanted her to marry Ludovick because he was powerful and wealthy.

"I will marry no one but Rheinhard," the maiden declared, but her father was proud and stubborn. "You shall marry the man I choose for you, and you may as well make up your mind to that," answered the father, and considered the matter settled.

The next day was set for the wedding ceremony and the fair Hinda looked beautiful in spite of having spent a sleepless night. Seated on a spirited steed, she rode next to her father on her way to church. Just in front of that building, she spurred her horse, and the nervous animal plunged forward. She directed him toward her lover's castle. Ludovick attempted to follow her, but just as Hinda's horse arrived at Reichenstein, the old man's horse stumbled and both rider and charger fell over the precipice and were killed. Rheinhard was his uncle's heir and inherited all his money and became lord of his vassals. The lovers were married and, as far as we know, lived happily ever after.

THE MOUSE TOWER

About the tenth century the people around Mainz had a very rainy summer. It rained constantly and when autumn came there was no harvest. The wheat and corn had rotted in the fields, and during the winter the poor people had nothing to eat. Bishop Hatto alone had a large supply of grain left over from the year before. Every day the starving poor crowded around Bishop Hatto's door, begging and pleading for some corn. At last the bishop appointed a day when all the poor should come to his barn and receive as much grain as they wanted. The people rejoiced at this good fortune, and when the day came the barn was filled with poor folk, women, children and men, young and old. When the barn was so full that it could not possibly hold any more, the wicked bishop shut the doors, set fire to the building, and burned all the people. The cruel man watched the fire and compared the shrieks of the people to the chattering of rats. After the entire building had burned to the ground, the bishop returned to his palace and after dining happily, slept as if nothing had happened. The next morning as he entered the main hall he noticed that the rats had eaten his picture out of the frame. A cold shiver passed through him and he knew that this was not the end of his trouble. From that time there was a plague of rats about him. They ate the food, gnawed the clothes and furniture and grew bolder and bolder. One day the bishop heard his farmer shout, "Fly, go away as fast as you can, for many thousand rats have eaten your corn and they are now coming this way. You are going to be punished for your sins at last."

"I am not afraid," answered the bishop, "for I shall go to my tower on a rock in the Rhine, where no rats can possibly reach me." Without delay he crossed the Rhine and entered this tower which he had built. Barring the doors, he thought that he was safe. He was soon disappointed, for thousands of rats swam the river, and soon they could be heard climbing the tower. In a few minutes they had entered by every window and every crevice, and had devoured the cruel bishop. The Mouse Tower, as

Copyright, Underwood & Underwood, N. Y.
Rheinstein is one of the best preserved of all the German castles, as well as being in one of the most picturesque locations. Below and to the right you can see the winding river at the foot of the steep cliff.

it is usually called, may still be seen on an island near Bingen.

THE BROWNIE AND THE FARMER

On a cold day in midwinter a poor farmer was painfully making his way through the forest near Seegburg. The ground was slippery and almost impassable, and the man had to stop very often to get his breath. It began to rain and the farmer's hands and face were red and cold. Hardly able to walk any further, the man looked imploringly to the sky for help.

"Hello, old farmer," a voice suddenly called. He looked around but could see no one.

"Here I am," was heard again and behold, under a root, a brownie was crouched on a hazel nut. Can you imagine how small was this little man, if he was able to sit on a hazel nut. He was leaning his head on one hand and stroking his long gray beard with the other.

"Are you very cold?" the tiny voice asked again.

"Of course, since I am not sitting under a root as you are."

"Your leathern breeches are too thin."

"They are too old."

"How old?"

"Oh! my grandfather left them to me, and I have not money enough to buy another pair."

"You poor man, I will give you a pair of my breeches," volunteered the little man. The farmer thought it was a great joke to think that he could wear the trousers, which apparently were not large enough to fit his finger. Nevertheless to please the brownie he tried to put on the breeches and behold, they fitted him as well as if the best tailor had made them.

"Thank you ever so much," said the farmer, and turned as if to depart.

"Wait," shouted the brownie, "where are you going?"

"I am going to the city to buy three pennies' worth of bread for my wife and seven children."

"Put your hand in your pocket and see how much money you have now." Astounded, the farmer pulled out six pennies.

"See," said the brownie, "your money will be doubled every time you count it, and you can soon become a rich man. Remember, never wear another pair of breeches, no matter how rich and powerful you may become." The farmer wanted to thank the brownie again but the tiny creature had disappeared.

The man now began to count his money and soon he had as much as he could carry. He hurried into town and bought bread, cake, meat and wine. Imagine the joy of the wife and the seven children. The farmer, industriously counting his gold, soon became the wealthiest man in the neighborhood. He built a magnificent palace and had a large store room filled with gold. Naturally enough, many of the dukes and kings who visited the palace wondered why the wealthy man wore such shabby leather breeches.

Finally the rich man thought, "It is a shame for one so powerful to wear such breeches. I will have them washed and then perhaps they will look better." The washerwoman hung them on a fence to dry and suddenly a strong blast of wind blew the breeches away. This of course was the work of the brownie. The next day when the man counted his money he found the same amount as the day before. Alas! his money no longer was increased, but don't feel sorry, for he still had a great deal.

ST. GOAR

Now Goar was a good religious man who came to the Rhine to make people happier. First he gave them religious instruction, and then gave them good things to eat. He taught them how to catch salmon and cook them, taught them to plant grape vines and to press wine. So of course you will not be surprised to hear that the people called their new town St. Goar. The good man was happy here, and when King Siegbert offered him a bishopric he declined, preferring to live with the people who loved him. If you chance to visit St. Goar, on the Rhine, you will see the grave of the man who aided the people of the Rhine. Countless legends are related about this holy man.

THE FOUNDING OF MAINZ

Fourteen hundred years before the birth of Christ there lived in the town of Treves, a magician called Reemug. He performed so many tricks, and annoyed the townspeople to such an extent, that it was decided to chase the wizard from the town. They pushed him through the gates of Treves and shouted: "Leave here at once and go to the place where the pepper plant grows." The magician shook his fist and cried:

"Wait! You shall regret this, for I will build a city here finer and more beautiful than Treves."

Instead of going to Borneo, where the pepper plant flourishes, he went to the Rhine, and by his magic caused a city to appear, at the place where the river Main flows into the Rhine. He called this city Mainz and it is now a larger city than Treves. Of course this tale may not be true, and you are privileged to doubt it, if you wish.

Copyright, Underwood & Underwood, N. Y.

Little is left of Castle Drachenfels, but there is enough to show how large and how strong it once was. It has been visited by thousands of tourists from all parts of the world. It is on the east bank of the river.

THE FEARLESS LOVER

In the town of Worms there stands an old castle known as Wampolder Hof. The keeper, or castellan, of this castle had a very beautiful daughter, who was so charming and lovely that all the youths in the neighborhood loved her and desired to marry her. For one only among all her lovers did the maiden cherish affection; and this youth was handsome, courteous, and of noble birth. They were betrothed, and all seemed well for the young couple.

One Walpurgis night, the time when the witches and goblins fly down from the mountains on their broomstick steeds, and make hideous noises, all the maidens and youths were assembled making merry and telling weird stories. Suddenly the daughter of the castellan said to her betrothed, "If you love me as you profess, go to the crossways, watch the procession of witches, and come back here to tell us what you have seen." Not wishing to seem cowardly the noble youth consented, and left the merry company.

One o'clock, two o'clock, three o'clock, and still the lad did not return. Frantic, the maidens and youths went to the crossways, but no one was there, and the youth was never seen again. The keeper's daughter, realizing her mad act, killed herself. Some said that her lover had been torn limb from limb by the angry witches, and his remains scattered to the winds; others say that the witches took him to their cave in the mountains. On Walpurgis night the castellan's daughter may be heard in Worms calling for her lost lover. Another story says that she may be seen in the castle, and that she must haunt it until some young man refuses to pay any attention to her, no matter how charming she seems to be.

THE ARCHITECT OF COLOGNE CATHEDRAL

When traveling on the Rhine it is customary for tourists to stop at Cologne in order to see the cathedral, one of the finest in Europe. The building is particularly beautiful and the following tale is often told.

The bishop of Cologne wished to have the richest congregation in the neighborhood and decided that in order to bring this about Cologne must have one of the finest cathedrals in Germany. The bishop at first determined to summon an architect from Italy, but hearing of a gifted young man who lived at Cologne, offered him a large sum of money if he could draw the plans satisfactorily. An architect is one who makes the plans and designs for a building before it is constructed.

The young man was delighted to receive this important commission, and immediately set to work. When he began to draw, he discovered that his talent had vanished and it was hopeless for him to proceed. He could not even draw a line. Heart-broken, the young man walked on the banks of the Rhine, trying to draw pictures on the sand. Suddenly he turned and saw a stranger also drawing a picture. This picture was a cathedral, and just such a one as the artist had dreamed of, but was unable to design. Looking carefully at the stranger, the architect noticed his wicked expression, and above all a tiny tail, which was almost concealed beneath his coat. He knew then that this was the Devil. The Evil One said, "If you sign a paper giving up all hope of ever going to heaven, I will give you the plans for the cathedral. Meet me at twelve o'clock to-night, and we will complete the bargain."

The architect, weeping, went to his priest, who also was anxious to have the cathedral built, who said to the young man: "Here is a piece of the Lord's cross, it will protect you against the Evil One."

That night true to their agreement the Devil and the architect met. The architect received the plans, but instead of signing the document he waved the relic, and the Devil, breathing fire from his nostrils, was unable to touch the young man.

"You cannot deceive me," said the Evil One, "for although you have the plans for the cathedral, your name shall never be remembered." The Devil's threat was fulfilled, for nowhere can you discover the name of the architect of Cologne Cathedral. There is a story that he lost his life while placing a stone on which his name was cut.

RHEINGRAFENSTEIN

The castle of Rheingrafenstein is perched high on a huge rock, and there is a curious story connected with its erection. A powerful lord thought that the top of the rock would make a fine site for a castle, for in case there should be war, the enemy would be unable to attack it. He soon discovered that it was impossible to build a castle on the cliff. The lord was much disappointed, and one day, the Evil One appeared and said that the castle could be built over night, if the lord gave him the first living creature who should look from its windows. The nobleman agreed, and the next morning, a beautiful strong castle stood on the heights. The lord was afraid to enter the palace, but his wife was clever, and riding ahead on a donkey, bade all follow her into the castle. When she came within the gates, she tied a cat on the donkey and drove the beast through the door. It went to a window and looked out. The Devil seized his prey, and fancy his disappointment when he found it was a donkey. He dropped the donkey on the rocks below, and vanished from the district, never to return.

These are only a few of the many stories of the Rhine, and its castles, rocks and caves. Sometimes the same story is told with different names, and sometimes there are two or more stories which give different explanations of some ruin, or some great natural curiosity.

THE NEXT STORIES ARE ON PAGE 4279.

WHAT THIS STORY TELLS US

WE think of stone as having always existed, and the stones of the earth were made a very long time ago. Man is making stone every day, however, and you have probably seen it many times. This story tells how a mixture of Portland cement, sand and pebbles may be poured into any shape, and how it gradually becomes solid stone. Few discoveries have been more important than that limestone or marl, heated with clay and ground to powder, makes a substance which is as strong as most stones, and can easily be made into any form desired. Every year concrete, as the mixture is called, is used more and more in building houses, streets, bridges, floors and dozens of other things.

HOW MAN MAY MAKE STONE

CONTINUED FROM 4182

ALL of you have seen walks, walls and steps that looked like stone, but were not stone. Perhaps you have seen men making them, but did not understand how a mixture of gray powder, sand, gravel and water could make a stone as hard as that that comes out of the earth. This story is to tell you how it is done.

First you must know that making stone is not a new idea. The old Romans made it, and some of the things they made are strong to-day, after nearly 2,000 years. Men soon learned that when lime was made wet and allowed to dry, it became hard. Since lime was sometimes hard to get, they found that it was still strong when mixed with sand. This is the common mortar which holds together the bricks in a wall. This mortar is a kind of stone. Later men found that if they mixed lime with other things they had a still stronger substance.

HOW PORTLAND CEMENT GOT ITS NAME

An Englishman burned limestone and clay together, and ground them into a fine powder. He found he had a substance which, mixed with water and allowed to dry, was as hard as some popular building stones. Because the blocks he made looked like the sandstone which came from Portland, he called it Portland cement, and this name is used everywhere, though it has nothing to do with Portland.

All that is needed to make Portland cement is to burn a limey substance with a clayey substance and to grind the result into a powder. In England they use chalk and mud from the rivers. In North America there are many kinds of stone and clay which can be used. If the right proportions of lime and clay are put together it makes no difference what is used.

Blocks made of this cement are more expensive than bricks, and so it is not used alone very much. It was found that it could be mixed with a great deal of sand and still be as hard as necessary, and would be even better for some purposes; and then it was found that pieces of broken stone could be used in addition to the sand. This mixture, then, of cement, sand and small stone, is called concrete, which means grown together or hardened.

Now concrete is the substance of which we build sidewalks, roads, steps, foundations, walls, bridges, pipes, vats, fence posts, floors, drinking troughs, houses and dozens of other things. You can think of some of these other things if you try. Now let us see how it is done, and what happens.

WHEN A FULL PAIL IS NOT FULL AT ALL

If you put all the potatoes you can into a pail you say that it is full, but that is not quite true. You can still put in a quantity of beans which will partly fill the spaces between the potatoes. Even yet some sand will fit in between the beans, and you will find that you can still pour in some water without making the pail overflow.

Copyright, 1918, by M. Perry Mills.

Something like this happens when concrete is made.

The sand partly fills the spaces between the pebbles or pieces of stone, and the fine cement fills the spaces around the grains of sand and with the water makes all stick together. Every grain of sand must be coated with a thin paste of the cement, and the sand and cement must fit tightly around the stones. If any air spaces are left, the concrete will not be strong, and will not hold water.

Perhaps you have seen men mixing all these things together in a box on the street or at your home. Where a great deal of concrete is to be used, as when a whole street is to be paved, or when a great bridge is to be made, you will see a large steel mixer into which all the materials are poured. This is made to revolve by an engine, and to it the men come with their wheelbarrows for a load, or the mixture may be loaded into wagons or buckets.

THE MATERIALS MUST BE MIXED CAREFULLY

Do not think that the materials are thrown together without any plan. The cement is expensive, and so no more is used than is necessary, but if too little is used the work will not be strong. By experiment men have found out the quantity of each it is best to use. For some kinds of work one part of cement, one of sand, and two of stone are used. For other kinds of work another part of sand, or even two more parts, may be added, and from two to five parts more of stone. We speak of one mixture as 1: 2: 4. This means one part of cement, two of sand, and four of stone are used.

The mixture is not hard when it comes out of the mixer, and so must be held in shape. This is done by forms, which are generally made of boards. If a wall is being built, boards are placed just the right distance apart, and the mixture is poured between them. In making a sidewalk boards are placed the desired distance apart and concrete is placed between them. You can make a trough by hanging one box inside a larger one, and pouring the concrete in between. The water begins to evaporate very soon and the concrete begins to set. Concrete will harden under water, however. In a few days it is quite hard and the forms may be removed, but it continues to grow harder for about two years. To make the surface smooth a thin coat of cement and sand without stone is plastered on.

STONE IS STRONG IN ONE WAY AND WEAK IN ANOTHER

Stone, as you know, will support a very heavy load if that load is placed directly on it, but as you know, it breaks easily if the weight is placed upon a part that is not supported. A stone beam is not very strong, but a stone pillar will bear an immense load. We say that stone, and concrete, too, are strong under compression, but weak under tension. But we can make concrete stronger than stone. By placing steel bars in the concrete, the beam is made much stronger. Sometimes a web of steel is buried in the concrete.

This combination of concrete and steel is called reinforced concrete, and is very strong. Concrete stands fire very well, and floors of concrete with steel rods through them are used to help make buildings fireproof. Such a floor is stronger than if made of real stone.

Perhaps some of you have ridden on the underground railways in New York. For most of their length a wide and deep ditch was dug. A skeleton of steel beams and rods was made for roof and sides, forms were placed around it, and the concrete was poured in. The result is a water-tight tube, which supports the traffic above without difficulty.

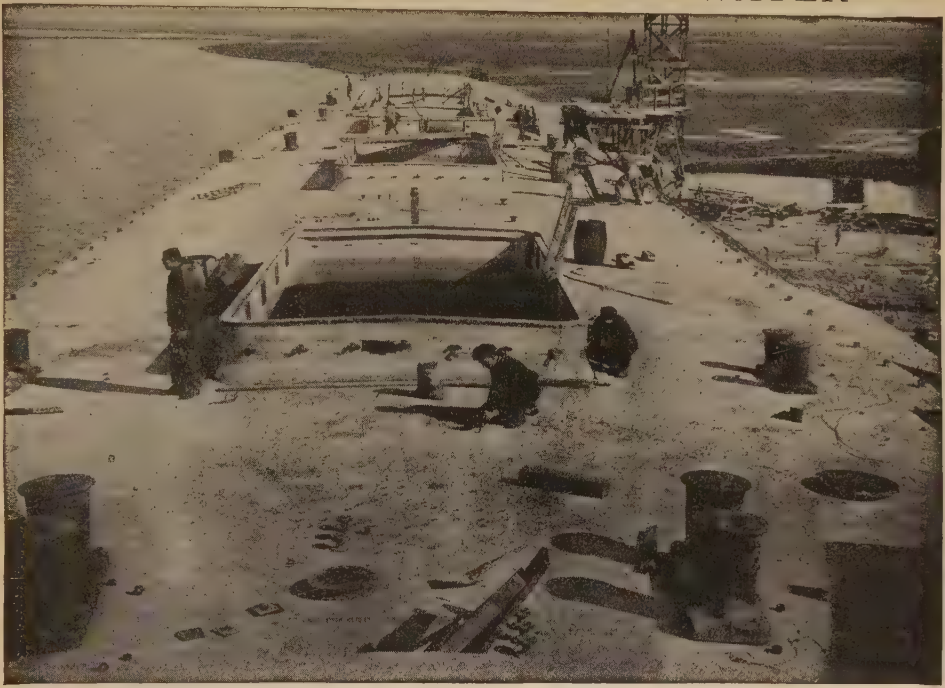
NEW USES FOR CONCRETE ARE CONSTANTLY BEING DISCOVERED

New uses are constantly being found for cement and concrete. For several years concrete had been used for barges around harbors, but in 1918, real concrete ships were launched. Steel rods were bent into the proper shape and concrete was poured into forms around them. If these ships prove themselves able to stand the strain of rough weather, a great change in the building of ships will follow. Ships can be built of concrete more quickly and more cheaply than of steel. Think of ships of stone on the world's highway!

Besides the pictures belonging to this story showing the use of concrete, you may see a flour mill and storage bins built of this material on page 5715, and a grain elevator on page 5614. Many of the bridges you see are of concrete, and the great dams and wharves in many places. The Catskill Aqueduct, of which we tell on page 5193, is largely concrete.

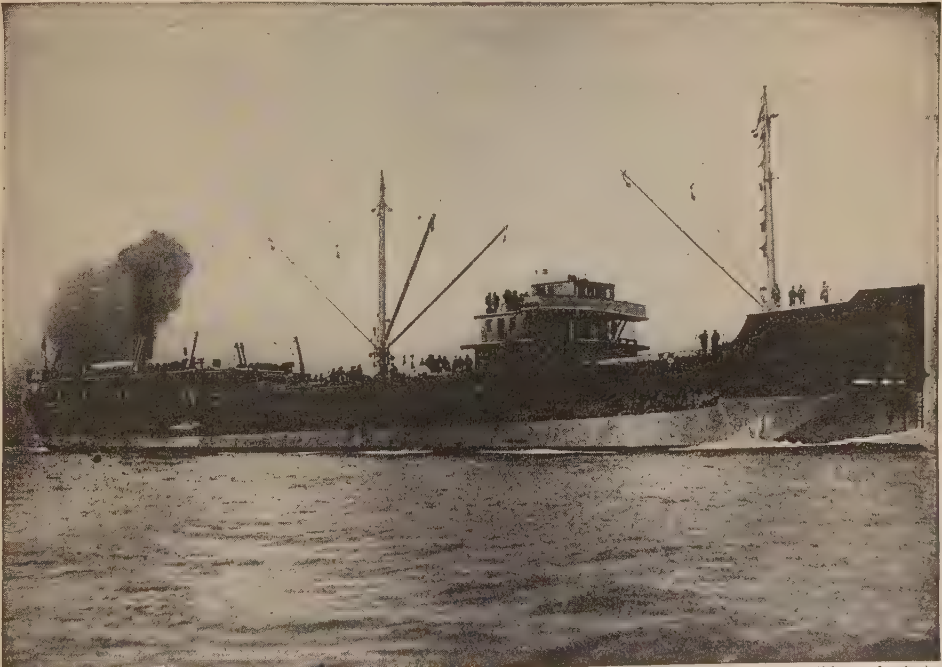
TPE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 4265.

A CONCRETE SHIP IN THE WATER



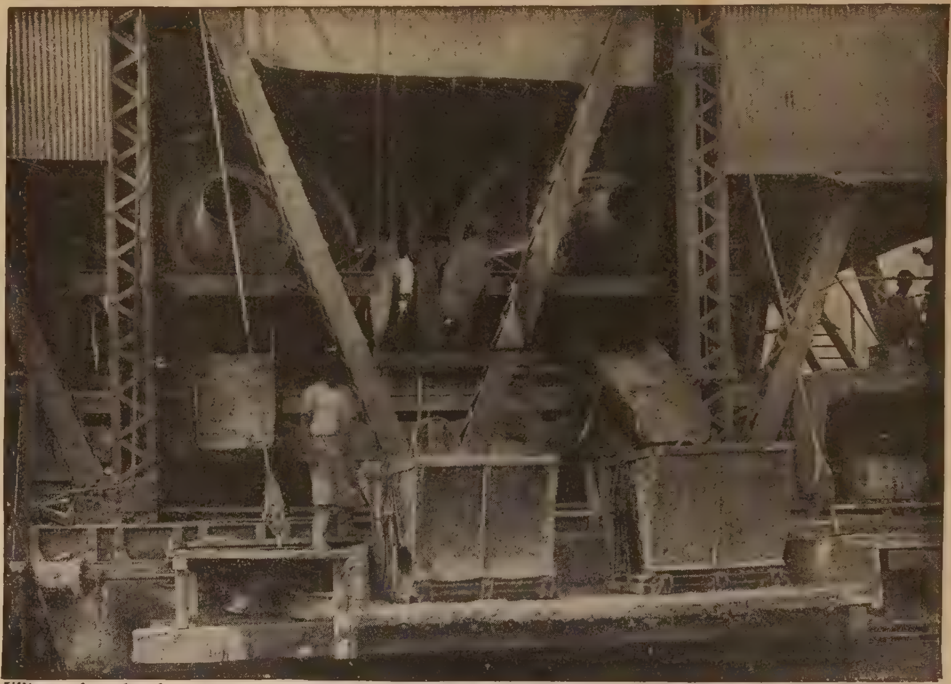
Copyright by Underwood & Underwood, N. Y.

Here is the deck of the concrete ship, Faith, just before it was completed. As you see, the deck and the coamings around the hatches, as the square openings through the deck are called, are of concrete. The boat is built entirely of concrete, re-enforced with steel, and was made in forms, a little at a time.



On her trial trip across San Francisco Bay, the Faith surpassed the expectation of her builders, both in speed, and smoothness of motion, easily making ten knots. The boat is 320 feet long, and will carry 5,000 tons of freight. As boats can be made of concrete in much less time than they can be built of steel or wood, we are likely to hear much more of them in the future. Many of them have already been built.

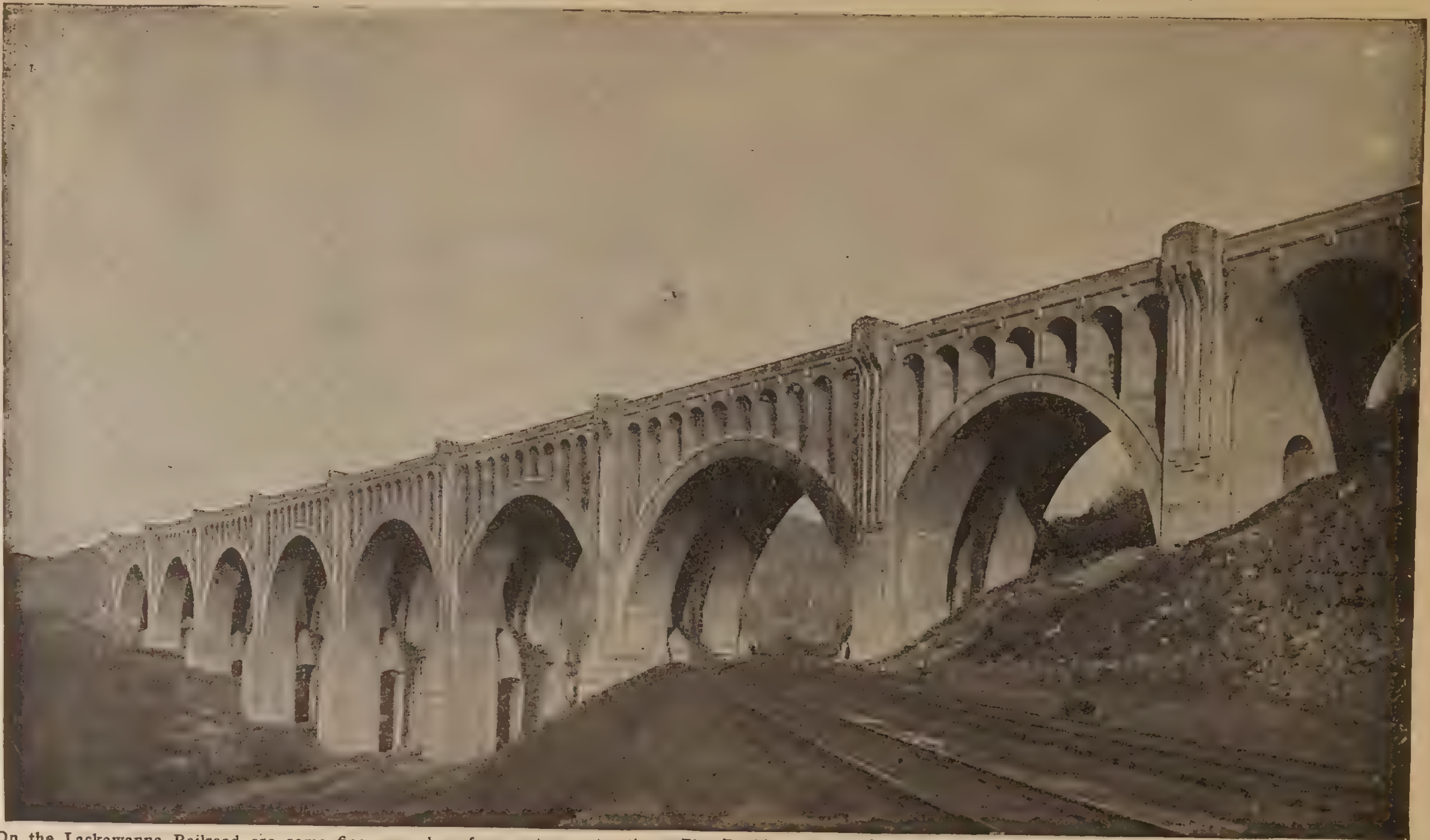
HOW CONCRETE IS PREPARED AND USED



Millions of yards of concrete were used in the construction of the Panama Canal. Here are two of the huge mixers into which cement, sand and broken stone and water were poured and churned together. They were then tilted forward and the moist mass was deposited in the huge square buckets which were swung off by a crane. Thousands of pounds were mixed at a time, and the mixers were constantly refilled.

This picture will give you an idea of how a great concrete bridge is made. The false arch of wood is left in place until the concrete has hardened. Above you see the wooden forms with steel rods sticking from them. The concrete is carried to them over the wire ropes, which make a sort of railway in the air. The wooden sides hold the concrete in place until it will support itself.

A FINE EXAMPLE OF CONCRETE CONSTRUCTION



On the Lackawanna Railroad are some fine examples of concrete construction. The Tunkhannock Viaduct is shown in the story of Bridges. This is the Martin's Creek Viaduct, which is nearly a third of a mile long, and 150 feet above the bed of the creek. Some of the spans are 150 feet. In making it, 77,500 cubic yards of concrete, and 1,600,000 pounds of steel were used. The old line of the railway is on the right. Much money has been spent by the railroads to make their tracks more nearly level.

MAKING A GREAT MODERN HARBOR

Dover, in England, is not only an important port for traffic to and from the Continent, but it is now a great naval station, and the harbor which was commenced in 1897, when finished, enclosed an area of over 600 acres. The total cost amounted to about twenty million dollars. Here we see part of the harbor works.

This picture shows us the yard at Dover where the huge concrete blocks for the harbor breakwaters were made. The blocks were cast in great wooden molds, and each was dated and numbered. The largest blocks weigh 42 tons each. The wooden piles, or beams, used in making the harbor, measured 100 feet each, and weighed 10 tons. The remains of an old Roman pharos, or lighthouse, were discovered at Dover.